The FOUNDRY

Volume 59
Number 22

Published
Semimonthly

CLEVELAND, OHIO, NOVEMBER 15, 1931

Castings in Humidifiers Last a Lifetime

PROVISION for correct humidity in the home or office during winter constantly is receiving more attention from both manufacturers of heating equipment and the public in general. Modern heating installations have

Water Evaporates from the Trough at the Top of Each Cast Iron Radiator

Courtesy Doherty-Brehm Co., Chicago

some particular feature to compensate for the lack of moisture in the air. An interesting type consists of a specially designed humidity radiator, with hollow, horizontal radiator sections made of alloy iron. The hollow sections of the humidifier act as heating units, with the heating medium—hot water, steam or vapor—flowing through the hollow part of each radiator section. The top of each section is in the form of a trough, and is kept filled from the city water main through a pressure reducing valve. The cast-iron radiator sections are enclosed in a attractive console cabinet. The manufacturers have the following to say about the materials of construction: "Our humidifier has been designed using cast iron for the reason that we have found it to be the most satisfactory metal both from the standpoint of supplying adequate heat for evaporation of the water and also from the standpoint of durability in construction. By having them made of cast iron we know that our humidifiers will last as long as the house."

Find Where Castings Can Be Sold.

CONTENTS

FEATURE ARTICLES

	Page
Foundry Is Located on Top Floor of Building	22
Tests Value of Soaking Cupola Charges— By W. H. Spencer and M. M. Walding	26
Philadelphia Wins 1932 Show of A. F. A.	28
Steel Founders Oppose Revision of Railroad Specification	29
Produces Engines for Automotive, Marine and Industrial Purposes—By Edwin Bremer	31
Award Safety Trophies	34
Prevent Losses with Proper Gates and Risers—By Pat Dwyer	37
Furnace Manipulation Governs Inclusions in Acid Open-Hearth Steel—By C. H. Herty Jr. and J. E. Jacobs	40
Determine Clay Content by Short Method	43
Bill Comments on Number of Men in Shop—By Pat Dwyer	46

REGULAR DEPARTMENTS

Reviewing New Books	30	**The Shakeout**	48
Questions and Answers on Foundry Practice	35	**Comings and Goings of Foundrymen**	49
Problems in Nonferrous Founding— By Charles Vickers	36	**Obituary**	50
		What Others Are Thinking	53
Foundry Family Photograph Album	45	**What the Foundries Are Doing**	54
		New Trade Publications	55

THE FOUNDRY is published semimonthly by the Penton Publishing Co., Penton building, Cleveland, O. Member, Audit Bureau of Circulations, Associated Business Papers and National Publishers Association.

Branch Offices: Chicago, Peoples Gas building; New York, 220 Broadway; Pittsburgh, Oliver building; Cincinnati, Schmidt building; Washington, National Press building; San Francisco, Alto building; London, Caxton House, Westminster, S.W.1; Birmingham, England, 14 New street; Paris, 9 Rue de Londres; Berlin, Burgstrasse 28, Berlin, C.2. Cable address, Irotrapen, London.

Subscription: United States and Mexico, $3.00 a year; Canada, $4 a year; Great Britain and other Foreign Countries, £1:0:0 a year; single copies 25 cents. Copies published three months or more previous to date of current issue, 50 cents each.

Copyright 1931 by the Penton Publishing Co.

Foundry Is Located on

Fig. 1—Each Molder Pours His Own Molds

ONE of the problems encountered in operating nonferrous foundries, particularly those pouring mainly large quantities of yellow brass, is that of the copious zinc fumes arising during the skimming and pouring operations. While some fumes arise during melting, little difficulty is observed, due to the fact that they are carried off to the stack. However, as soon as the pot or crucible is lifted from the furnace, dense fumes of zinc oxide arise. If the foundry is not well ventilated, fumes pollute the atmosphere and render conditions uncomfortable.

Various means have been tried to suppress the fumes, including the use of fluxes and certain metallic elements, without any marked dimunition of the fumes. It is claimed by many that zinc losses, and consequently fumes, are lower in brass rolling mills than in foundries due to the prevailing use of common salt as a flux on yellow brass melts. Others state that the use of salt does not reduce zinc losses. Addition of small quantities of aluminum in yellow brass also is claimed to suppress fumes through its ability to form a thin, but tenacious, film over the molten metal which persists even in the solid state.

Aluminum undoubtedly does have some effect in the direction of suppressing fumes. While dif-

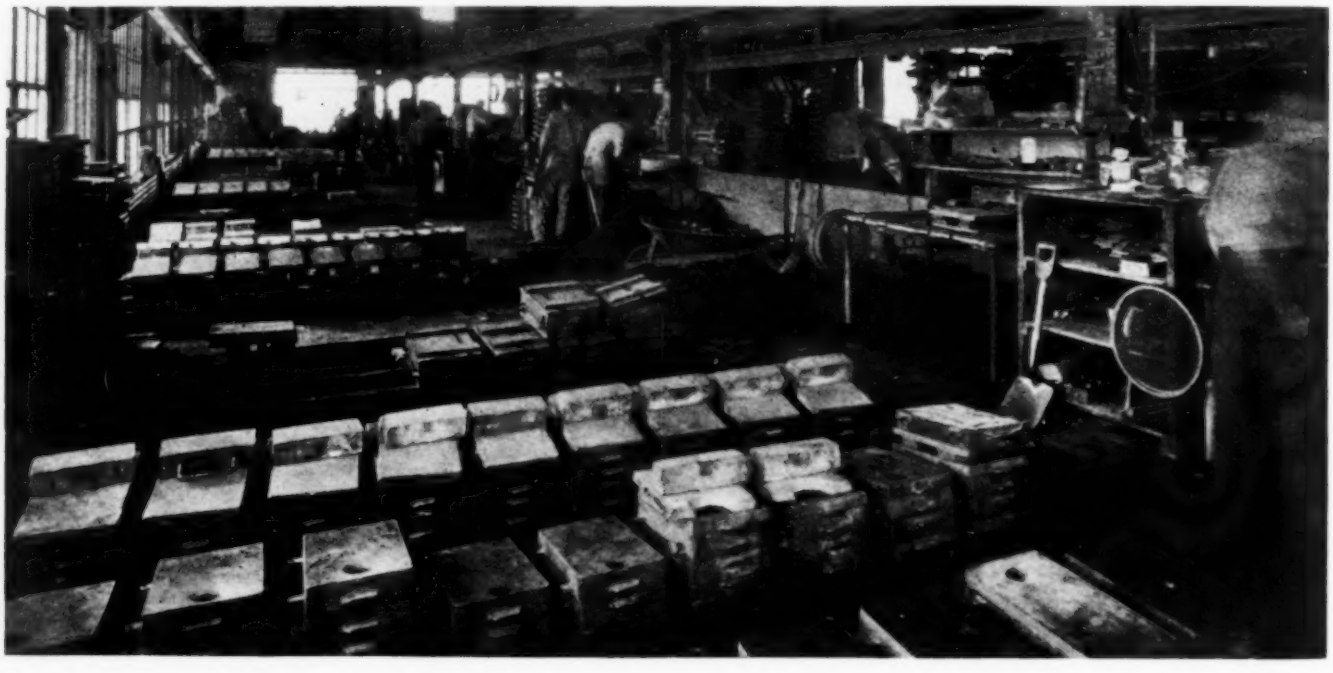


Fig. 2—One Side of the Building to the Right, Is Devoted to Core Room, Cleaning, Locker Room, Elevators, Etc., and the Remainder of the Floor Is Used for Molding

Top Floor of Building

Light and Ventilation Feature Arrangement of Middlewestern Nonferrous Shop—Advantages Outweigh Possible Disadvantages

ficulty is encountered with high zinc brass in obtaining castings from from zinc smut or smoke, evidenced by whitish or grayish patches, when two or three ounces of aluminum per hundred pounds of brass is added, the castings run sharp, and are free from zinc smoke, although the skin of the castings presents a faint, but perceptible silvery sheen of aluminum to the practiced eye.

The main reason for adding aluminum to high zinc brasses is to obtain the requisite fluidity, as it is well known that such alloys are sluggish. Although aluminum confers certain desirable properties on yellow brass, its use is limited to those castings which do not have to withstand pressure. Due to its affinity for oxygen, aluminum is converted rapidly at high temperatures to its oxide, alumina, which is distributed throughout the brass as thin films of dross. While probably not continuous the films are so distributed as to prevent solid pressure proof castings.

Ventilation Is One Solution

Since suppression of fumes has not met with any great degree of success, attention has been turned to ventilation as a means to remove the fumes from the foundry as rapidly as possible. A common method of ventilation employed in brass foundries is the monitor type roof with its raised portion in the center running the full length of the roof. The sides of the monitor contain window sash, which may be opened and closed and, of course, the walls of the building also contain windows. Such a system depends upon a natural draft created by the warmer column of air within the building rising to and passing out through the monitor windows, and fresh air coming in through the windows in the walls.

Other types of ventilating roofs sometimes are used, and as a general rule, all, including the monitor roof, perform their function of ventilating the building reasonably well. However, at times those systems fail to work for short periods and at other times fail to operate completely. The former usually is occasioned by adverse atmospheric conditions such as wind direction, air humidity, etc., while the latter generally is caused by the erection of higher structures close to the building depending upon natural ventilation. The higher structures create disturbances in air currents, and often send currents of cold air down through the monitor of the adjoining building.

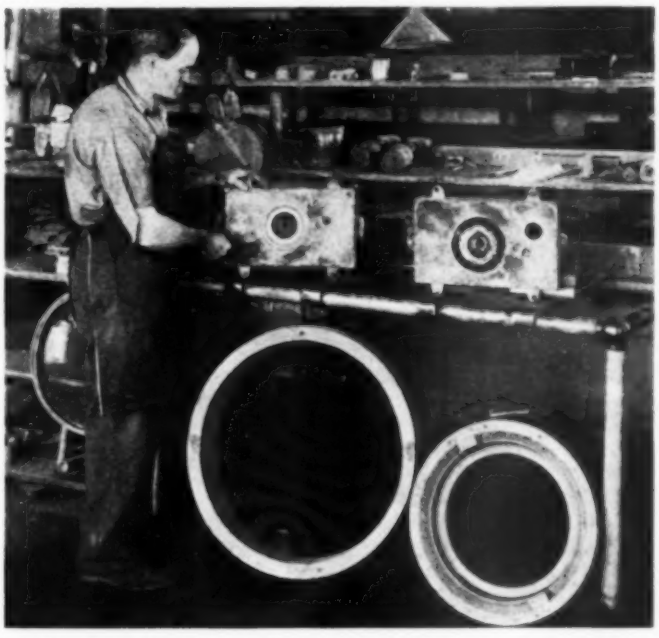


Fig. 3.—Ring Gear Blanks Are Made in Various Sizes

When the latter occurs the smoke and fumes back into the foundry to the consternation of the employes and management alike. In such cases a number of possibilities are open to eliminate the smoke and fumes and the discomfort attending them. A system of forced ventilation drawing air from outside the building and sending it up through a number of strategically situated vents inside the building, sometimes is used. The incoming air carries the smoke and gases upward and out of the monitor openings. Another method is to install a number of powerful exhaust fans in openings in the monitor, or employ a suction duct system attached to the exhaust fans.

One other way to solve the ventilation problem, which may appear somewhat farfetched, would be to install the brass foundry on the top

floor of a building as high as those surrounding it. Then the monitor would function as it should. While some may point out that with the foundry located on the upper floor of a building, the bulk of the raw materials have to be stored on the ground or in the basement, elevated to the foundry as needed, and the finished product transported to the ground, the plan has been operated successfully in several instances.

One example of a foundry located in the upper story of a building is the Rockford Brass Works, which is on the top floor of a 5-story building. That company produces plumbing fittings for its own use and in addition engages in jobbing work in brass and bronze castings of various types. Originally the company maintained its foundry and machine shops in 1-story structures, but as its business expanded, it became evident that a new building was necessary to house the various departments. Due to ventilation problems encountered in the old foundry, it was decided to install the foundry in the top floor of the building instead of on the ground level.

Conditions Are Improved

While the new location may be said to have certain disadvantages in that all the raw materials as previously mentioned have to be stored in the basement, and elevated to the foundry, the advantages far outweigh the disadvantages. Ventilation, while not perfect, is far superior to that existing in the old foundry. Many machining and other operations have to be performed on the plumbing fittings the firm manufactures as a finished product, and that work is conducted on the floor below the foundry which permits straight line production. The third floor is devoted to storage of the finished castings, and the second to offices. The first or ground level floor contains a large showroom in the front and the shipping department in the rear.

The building is approximately 75 x 125 feet facing the west. The core room, about 25 x 30 feet, is in the southwest corner of the building, and elevator and stairway are in the southeast corner. The 25 foot strip on the south side of the building between core room and stairway is occupied by the workmen's locker room, and cleaning department. The remainder of the floor space is devoted to molding except for that occupied by the melting units and chimney along the east end of the building. A general view of the foundry along the north side is shown in Fig. 2.

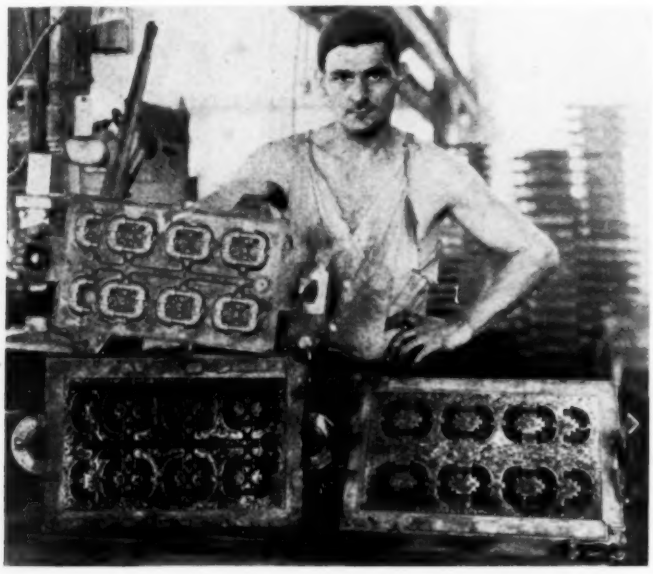


Fig. 4. — The Matchplate, Cope and Drag Molds for Making Elbows Showing the Method of Gating

Metal is melted in 9, coke-fired, crucible furnaces located in a steel brick-lined pit which extends about 4 feet into the room below. The pit is approximaly 6 x 6 x 18 feet including the space occupied by the furnaces; the tops of the furnaces being at the floor level. The molten metal is conveyed to the floors in melting crucibles suspended from chain hoists mounted on hand-operated cranes spanning the molding floors. Crucible tongs hold the crucible.

While the major portion of castings produced are light in weight and section, some in the medium class, such as bronze ring gear blanks 30 inches in diameter, are made. Molds are produced on the bench and on 9 post type squeezer machines supplied by the Moline Iron Works, Moline, Ill. The machines are mounted on the columns shown at the right in Fig. 2, and the molding floors extend from either side of the columns.

Careful study of the various factors entering into the production of castings at the Rockford Brass Works, has led to an equitable distribution of labor in which the molder, while retaining responsibility for the number of good castings made, is not required to perform all work incidental to the production of castings by hand molding. The molder's work consists of making the molds, setting the cores, and pouring off. The molten metal is brought to his floor on one of the previously mentioned cranes by two men who assist in handling the metal. One of the men handles the chains on the hoist block to raise the crucible; the other wields the skimming rod to hold back the charcoal and slag, and the molder pours the metal. In addition one man shifts the weights from mold to mold. When the three men are not engaged in pouring, they shake out the molds, pile up the flasks or bands as the case may be, pick out and carry away the castings, and recondition the sand for further use.

Make Ring Gear Blanks

As previously mentioned in addition to producing a line of brass plumbing fittings for its own use, the firm also engages in jobbing work. Examples of both types of work are shown in Figs. 3 to 6 inclusive. Fig. 3 illustrates three different sizes of patterns for bronze ring gear blanks, from which castings are made for a prominent machine tool builder. The two large patterns resting on the floor are 30 and 24 inches in diameter while the

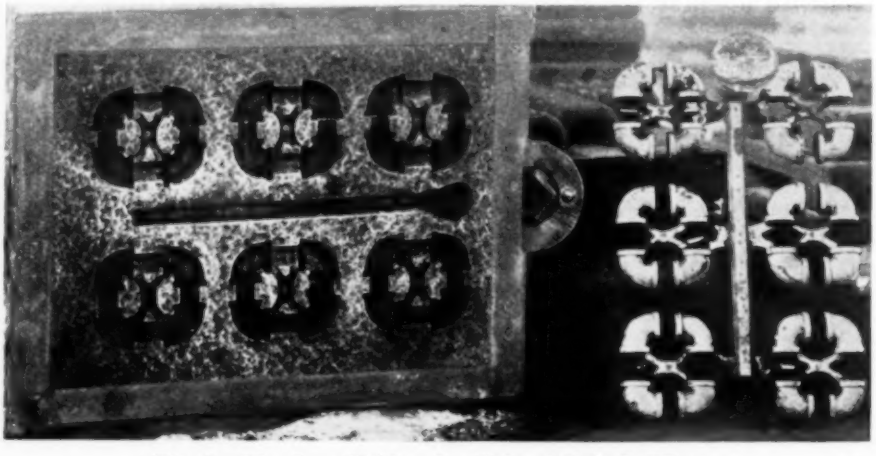


Fig. 5—The Cope Mold and a Gate of ¾-inch Elbows

small one in the mold is about 4 inches in diameter.

While the gate has not been cut in the small mold shown at the top of Fig. 3, the manner of gating is extremely simple, and may be described as follows: From the sprue opening in the cope mold shown at the upper right, a channel or branch about 2 inches long is cut at a slight angle from the perpendicular to a small button-like depression previously made when the mold was rammed. A replica of the button depression is made in the drag directly opposite that in the cope at the same time, and the channel or branch leading into the casting cavity is cut from the drag button. The channel cut in the drag is almost at right angles to that in the cope. Through the described arrangement of the gate or runner, several things are accomplished. First by having the channel make a right angled turn, the molten metal is forced to make an abrupt change of direction which reduces the turbulence of the flowing stream considerably, and allows metal to enter the mold quietly. Secondly by cutting part of the gate in the cope and part in the drag, a skimming effect is produced which tends to retain floating particles at the point of the gate change from cope to drag.

Fig. 4 shows molds and pattern plate for making ½-inch elbows. The pattern plate, to a large degree, is typical of that used in the production brass foundry in that as many castings as possible are made in a flask of a definite size. Theoretically, of course, the flask should be designed for the pattern to reduce the amount of sand required, but that method may lead to the necessity of maintaining a wide variety of different sized flasks to accommodate the numerous patterns. However, by making some comparatively slight changes in the patterns as indicated in Fig. 4, it is possible to standardize on a few sizes of flasks.

Fill Cavities Rapidly

The plate shown in Fig. 4 which is a matchplate and contains 28 patterns arranged in groups of four, except at one end. The runners and gates as may be observed, are in the cope. Branch gates leading from the main runner feed metal into the flanges of the elbows nearest the runner. Gates are cut along the core print, and on the opposite side of the print, other branch gates are cut to feed those elbows farthest from the runner. With such gating, the filling of the four cavities comprising a group is practically simultaneous.

The molds are made on a post-type squeezer machine as follows: The molder places the drag snap flask on his bench with the pins up. The matchplate in its proper position is slipped over the pins, and the cope snap flask adjusted. The whole is rolled over so that the drag flask now is uppermost, and placed on the platen or base of the squeezer. A layer of molding sand is riddled onto the face of the pattern. Then the flask is filled with a few shovelfulls of sand and struck off level. A bottom board slightly smaller than the inside dimensions of the flask is placed on the sand surface, and the whole rolled over so that the cope flask now is up. A layer of sand is riddled onto the face of the pattern now showing; the flask filled as previously described, and struck off level.

A bottom board similar to that mentioned is placed on the sand surface, and the lever of the squeezer machine pulled forward. The head of the machine acting through the boards on the cope and drag compresses the sand to the desired density in those flasks at the same time. The squeezing action as may be surmised, forces the sand about ½-inch below the edges of the flasks at the points where the boards are placed. After squeezing the mold the molder pushes the lever back to its original position, and removes the board on the cope mold. He lifts off the cope mold with the assistance of a vibrator attached to the matchplate, and sets it aside. Then he lifts the matchplate and sets it to one side also. After examining the faces of the cope and drag molds for defects, the molder replaces the cope on the drag, releases the catches on the snap flasks, and removes both flasks from the sand molds. A thin steel band about 3 inches wide is slipped over the molds, and pressed home at the joint to prevent shifting, runouts, etc. at that point. The complete mold on its bottom board then is placed on the floor. One molder makes and pours off 160 such molds a day.

Fig. 5 shows the cope and a gate of castings of ¾-inch elbows. Since these are made similarly to the ½-inch type just described, it will not be necessary to include the method of manufacture. However, attention may be called to the fact that the flasks used in producing 24 of the larger elbows have the same dimensions as those for making 28 of the ½-inch elbows. Comparison of Figs. 4 and 5 shows how the otherwise waste space is utilized to produce four additional elbows in the ½-inch size. There is a slight difference in gating between the two sizes of elbows as may be observed through a study of Figs. 4 and 5. In the ½-inch elbows, shown in Fig. 4, the runner and gates are in the drag while with the ¾-inch elbows the gating is partly in the drag and partly in the cope.

The main runner as in the case of the smaller elbows is placed in the cope, but the branch gates leading runner to the casting cavities are located in the drag. Other branch gates, which carry the metal from the cavities nearest the runner to those farthest away, are placed in the cope similar to the arrangement for the ½-inch elbows. The particular arrangement was designed to permit ease in attaching the gates to the patterns, and to obtain a slight skimming effect engendered by attaching the gates on the underside of the runner.

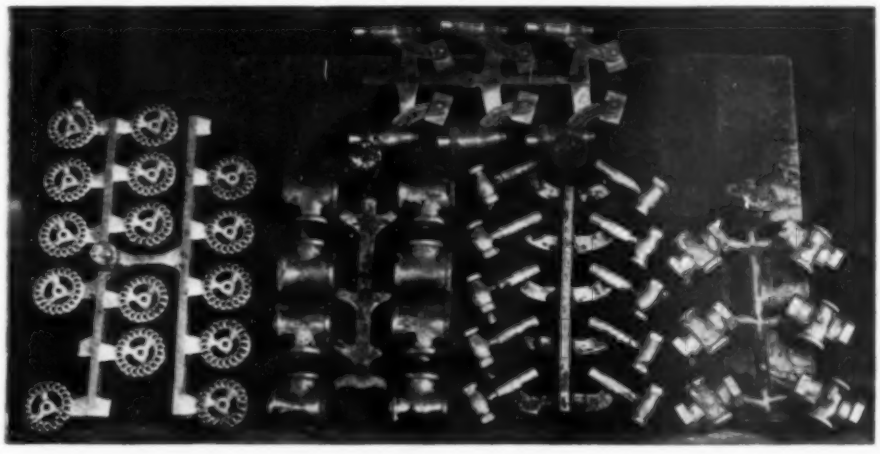


Fig 6—A Collection of Castings Showing the Methods of Gating Employed

Employ Various Methods

In addition to the castings described, several others are shown in Fig. 6 in the form of gated castings or patterns. The gate of castings shown at the left is a rather queer arrangement, but it happens to be some valve wheels in white metal which later will be used as patterns. Hence, the method of arrangement is not indicative of anything except a quick way to get as many castings into one flask with the least effort. The several groups indicate variations in gating different castings, which have been mentioned before.

The gate of T-fittings arranged next to the valve wheels at the right is gated completely in the drag; both

(*Concluded on Page* 44)

Tests Value of
SOAKING CUPOLA CHARGES

By W. H. Spencer and M. M. Walding

THE theory often has been advanced that charging a cupola from 1 to 2½ hours before the blast is put on will give hotter and better first iron. This article deals with a series of tests designed to find the effect of varying the soaking time.

Use Different Cupolas

Two of the cupolas used in this test were ordinary, cold-blast cupolas, differing only in the diameter of the melting zone. Cupola No. 8 was boshed 2 inches and cupola No. 9 was boshed 6 inches on the diameter at the melting zone. Table I gives the dimensions of these two cupolas. The other units used were hot-blast cupolas of the Moore type.

The same kind of coke was used for all tests. In cupolas 8 and 9 the same weight of iron, coke and limestone was used in all cases, except in making up the bed. The iron charged weighed 3000 pounds and coke between charges was 300 pounds. Flux was 80 pounds of limestone on the bed and 60 pounds between charges. In cupolas Nos. 5, 6 and 7, the total iron charge was 12,000 pounds, the coke between charges 1300 pounds and the flux was 400 pounds of limestone with 20 pounds of purite in all tests.

The first group of tests consisted of one charge of 100 per cent steel with 2 per cent of 15 per cent ferrosilicon, followed by regular charges. The bed for this series was 48 inches high and was burned until red spots were showing through. Melts were made in cupolas 8 and 9. Results are shown in Table II. The average temperature of the first three ladles, 3000 pounds each, is given. Temperatures were read on the stream by an optical pyrometer, calibrated by the United States bureau of standards.

Temperature of the stream tends to be lower with longer soaking time. Melting rate, as shown by time from blast to first tap, is more rapid on longer soaking periods. Average carbon shows practically no change. The sulphur content of the melt, except for one test, is lower with more soaking.

The second group of tests, shown in Table III, is a series in cupola 9 on a well-burned 40-inch bed. The mixture used contained 61 per cent pig iron, 26 per cent cast scrap and 13 per cent steel. Blast pressure was 12 ounces and the average phosphorus content, 0.65 per cent. Melting temperature, time for first tap and sulphur content of melt all show a drop at 105 minutes and a rise at 135 minutes soaking time. Carbon content gives a gradual rise with increased soaking time.

Carbon and Sulphurs Vary

The next group shown—Table IV—consists of melts of 50 per cent steel and 50 per cent pig iron on a 48-inch bed. Thirty-eight inches of this bed was well burned and 10 inches of fresh coke was added just before the first charge. Blast pressure on these melts was 15 ounces and phosphorus content 0.45 per cent. Cupolas 8 and 9 were used. In this group the average temperature for both cupolas shows a slight drop with the longer soaking time. Melting rate, as in both previous groups, is more rapid for the long-soaked charges. Carbon and sulphur contents are erratic, due to the mix-

Melts Faster

THE idea of soaking charges in the cupola to produce hotter first iron has been a debatable point for many years. To test out the theory in practice, the authors conducted a series of experiments with different cupolas, charges and blast pressures. These tests lead to the conclusion that while no especially beneficial results obtained from soaking the charges, the melting rate, as shown by the time required to melt a given amount of iron, tends to be lower with the longer soaking periods. The article is abstracted from a paper presented at the Chicago convention of the American Foundrymen's association. Mr. Spencer is melting superintendent and Mr. Walding is assistant melting superintendent, American Cast Iron Pipe Co., Birmingham.

Table I

Dimensions of Cupolas Used

Cupola No.	No. tuyeres.	Height of tuyeres above sand bottom, inches.	Height of charging door above tuyeres, feet.	Diam. at charging door, inches.	Diam. at melting zone, inches.	Diam. in basin, inches.	Tuyere dimensions, inches. Inside cupola.	Smallest place.
8	6	11	14	54	52	54	4 x 21	3 x 15
9	6	11	14	54	48	54	4 x 21	3 x 15

Table II

Tests Using Steel Charges

(All-steel melt on 48-in. bed; blast 15 oz.; phosphorus 0.4%)

Cupola No.	Soaking time, minutes.	Blast on to 1st tap, minutes.	Temperature, degs. Cent. 1st tap.	2nd tap.	3rd tap.	Analysis of 1st ladle. Si, %	S, %	TC, %
9	150	29	1472	1460	1444	1 50	0 102	3 12
8	15	38	1480	1464	1460	1 74	0 092	3 12
9	5	50	1484	1488	1476	1 42	0 095	3 17
8	105	35	1468	1448	1440	1 57	0 078	3 22
9	105	35	1484	1452	1440	1 57	0 086	3 01

Table III

Pig Iron, Scrap and Steel Mixture

(Pig iron mixture on 40-in. bed; blast 12 oz.; phosphorus 0.65%)

Cupola No.	Soaking time, minutes.	Blast on to 1st tap, minutes.	Temperature, degs. Cent. 1st tap.	2nd tap.	3rd tap.	Analysis of 1st ladle. Si, %	S, %	TC, %
9	135	30	1428	1440	1436	1 55	0 076	3 60
9	15	38	1420	1436	1424	1 57	0 065	3 57
9	105	25	1416	1424	1420	1 63	0 062	3 59

Table IV

Using Pig Iron and Scrap in Charge

(50% pig and 50% steel on 38-in. plus 10-in. bed; blast 15 oz.; phosphorus 0.45%)

Cupola No.	Soaking time, minutes.	Blast on to 1st tap, minutes.	Temperature degs. Cent. 1st tap.	2nd tap.	3rd tap.	Analysis of 1st ladle. Si, %	S, %	TC, %
8	135	35	1468	1460	1456	1 64	0 085	3 24
9	125	30	1460	1452	....	1 50	0 086	3 32
8	15	40	1484	1476	1460	1 48	0 088	3 44
9	15	40	1468	1464	1444	1 46	0 074	3 22
8	75	35	1484	1476	1476	1 73	0 075	3 44
9	75	48	1460	1452	1440	1 54	0 094	3 32

ture consisting of 50 per cent each of such widely different materials as pig iron and steel.

The group recorded in Table V is a mixture of 75 per cent pig iron, 12 per cent cast scrap and 13 per cent steel, melted on a 58-inch bed in cupolas Nos. 5, 6 and 7 of the hot blast type. Blast pressure was 14 ounces and phosphorus, 0.70 per cent. That group contains more tests than any other and shows greater inconsistency. The length of time from blast to first tap in that series is open to question because shop conditions demanded iron at a fixed time and, the basin of the cupola holding more than a ladle, it is not certain that in all cases there was the same amount of iron melted when the cupola was tapped.

Results of the series of tests show that average temperature of the first three ladles in cupolas 8 and 9 tends to be lower for the longer soaking periods. In cupolas 5, 6 and 7 the results were more erratic, and around the 90-minute soaking period show high temperatures.

Melting rate, as shown by the length of time required to melt a given amount of iron, is faster for the iron which has been soaked longest. Cupolas 5, 6 and 7 were not considered because of some doubt that a fixed amount of iron was melted before tapping.

Total carbon content of the melt seems to be independent of the soaking time. Sulphur content of the melt in most cases increases with longer soaking. In cupolas 5, 6 and 7, where a desulphurizer was used, the sulphur content is lower on longer soaking.

Unmeasured factors—such as condition of bed, possible atmospheric changes, placing of charges, etc.—seem to have sufficient effect on the results to make the stating of exact laws, on the result to be obtained from any one soaking period under shop conditions, a doubtful undertaking.

No especially beneficial results were obtained from soaking the charges. In fact, it seemed as though more heat was lost through burning the bed during the soaking time than was recovered in heating of the charge. The coke burned with natural draft over a long period of time did not give as much heat to the charge as that coke which burned rapidly with the blast on the cupola.

Association Features Testing of Welds

A comprehensive discussion of methods for testing oxyacetylene welds featured the thirty-second annual convention, International Acetylene association, at the Congress hotel, Chicago, Nov. 11, 12, and 13. At the weld-test session, Nov. 11, Prof. H. L. Whittemore, United States bureau of standards, spoke on the importance of tests to welders and to users and makers of welded products. A dramatized demonstration of visual and stethoscopic tests; hammer, bending, tension and hardness tests; invisible-ray tests; specific gravity, compression, and internal pressure tests also was presented.

Among the timely speeches at that session was "Today's Opportunities for Welding-Trained Men in the Metal Working Trades and Industries," by Dr. S. Lewis Land, educational director of the Heating & Piping Contractors' National association; and "Training Gas Welders for the Job," by Thomas Jones, superintendent of welding for the Illinois Steel Co.

The other sessions covered every important field where oxyacetylene welding is used.

Engineers Elect

Conrad N. Lauer, president, Philadelphia Gas Works, Philadelphia, will assume the presidency of the American Society of Mechanical Engineers at the annual meeting to be held in New York, Nov. 30-Dec. 4, it has been announced by the society following tabulation of the mail ballot.

Vice presidents were elected as follows: Robert M. Gates, vice president, Superheater Co., New York; Charles M. Allen, professor of hydraulic engineering, Worcester Polytechnic institute, Worcester, Mass.; Fred H. Dorner, mechanical engineer, Milwaukee; and Williams B. Gregory, professor of experimental engineering, Tulane university, New Orleans.

Three new managers selected were: Alexander J. Dickie, editor, *Pacific Marine Review*, San Francisco; Eugene W. O'Brien, editor, *Southern Power Journal*, Atlanta, Ga.; and Harry R. Westcott, president, Westcott & Mapes Inc., New Haven, Conn.

October freight car awards totaled 780 units, compared with 503 in September and 4116 in October, 1930.

Quad-City Group Hears Talk on Pig Iron

Eighty-seven members and guests attended the October meeting of the Quad-City Foundrymen's association, which was held at the Davenport chamber of commerce, Davenport, Iowa, on Monday, Oct. 19. O. L. Pringle, vice president and general manager, St. Louis Coal & Coke Corp., St. Louis, addressed the group on "Production of Pig Iron."

Starting with a brief history of that ferrous metal, dating back to the time before Christ, he developed rapidly the progress of iron making to the introduction of the blast furnace in America. He pointed out that serious thought was given to the production of iron in the blast furnace in 1867 and from that date to the present, the United States has played an important part in the pig iron production of the world. In the early days of coke and pig iron production, furnaces were located near the mines of either the ore or the coal.

The yearly production of pig iron was shown on charts and the speaker pointed out that 900 pounds of iron per inhabitant were produced during the five years immediately preceding the present depression. Mr. Pringle believes that while that figure has dropped to 400 pounds per inhabitant, it seems logical that it must return to its previous level in the near future, which in turn means a resumption of trade.

The progress made in increasing the production of blast furnaces also was shown on a chart. Output per furnace has developed from 120 tons per 24-hour period to 1000 tons in the like period. A brief description of the method of making by-product coke also was presented.

The members of the Quad-City group paid a tribute to A. E. Hageboeck, president, Frank Foundries Corp., Moline, and director of the group, who recently was elected president of the Gray Iron Institute at the annual meeting.

Table V

Test with High Coke Bed

(75% pig, 12% scrap and 13% steel on 58-in. bed in cupolas Nos. 5, 6 and 7; blast pressure 14 oz phosphorus 0.7%)

Cupola No.	Soaking time, minutes.	Blast on to 1st tap, minutes.	—Temperature, degs. Cent.— 1st tap.	2nd tap.	3rd tap.	—Analysis of 1st ladle.— Si, %	S, %	TC, %	Remarks.
7	100	35	1468	1472	1476	1.38	.086	3.51	Extra steel
5	95	33	1476	1480	1480	1.46	.084	3.51	Extra steel
6	90	37	1476	1476	1472	1.54	.087	3.60	
6	20	35	1476	1476	1472	1.37	.098	3.57	
5	85	35	1480	1476	1468	1.51	.070	3.59	Special pig iron
6	20	35	1464	1476	1468	1.30	.095	3.61	
7	65	42	1460	1468	1472	1.46	.083	3.60	
5	15	33-	1476	1472	1472	1.30	.096	3.58	
6	105	35	1484	1472	1468	1.39	.080	3.60	
7	120	35	1468	1468	1460	1.44	.081	3.60	

Entrance to the Beautiful New Municipal Convention Hall at Philadelphia

Philadelphia Wins 1932 Show Of A. F. A.

THE thirty-sixth annual convention and exhibit of the American Foundrymen's association will be held in Philadelphia, May 2 to 6, 1932, according to an announcement just made by C. E. Hoyt, executive secretary of the asociation. All convention and exhibit activities will be centered in the beautiful new municipal convention hall, located at Thirty-fourth street and Vintage avenue adjacent to the building which housed the 1928 show.

In this new building, one of the most completely furnished and equipped convention halls in the country, provision will be found for adequate exhibit space, with unusual facilities and splendid meeting rooms for all convention sessions, making possible the holding of practically all phases of convention week under one roof.

Tentative plans for the 1932 program include a number of practical shop-operation and round-table sessions of the type which proved so popular at the 1931 Chicago convention that the meeting rooms there were taxed to capacity. However, the Philadelphia convention hall has broad facilities in the way of meeting rooms to fit any requirement of the anuual foundry meeting.

The main meeting rooms include the ballroom, with a seating capacity of 1300; the ballroom extension, seating 300; ballroom balcony, 350; lobby lounge, 350; and restaurant extension, 350. All of these rooms can be served from the main dining hall kitchen, which is as modern and completely equipped as any first-class hotel or club kitchen. The main convention hall restaurant is located directly below the lobby at the end of the exhibition hall.

Large Halls Available

For exhibit purposes two large, well-lighted and well-ventilated halls are available in the new convention building. These halls are the arena or auditorium, and the exhibition hall proper. Complete power facilities are available, including provision for both alternating and direct current, gas, compressed air, hot and cold water and live steam.

The arena, having a seating capacity of 13200, is built in the form of an amphitheater with a height of 88 feet from floor to ceiling and without support columns of any kind. The arena stage, which is 116 feet wide by 56 feet deep, can be used either for additional exhibits, or converted into a meeting room by lowering the steel-asbestos fire curtain.

The exhibition hall, over-all dimensions of which are 146 by 250 feet, is on the lower floor and conveniently adjacent to the main convention hall restaurant. This restaurant is beautifully paneled in walnut and is unusually accessible to any part of the building.

Handling of freight and materials in and out of the convention hall will be provided for economically and exceptionally well. A siding of the Pennsylvania railroad enters the building itself alongside a receiving platform, all under cover and with the platform on a level with the car floors. Materials thus can be handled promptly and directly into the exhibition hall, on the same level, or to the arena floor by elevators of 20-ton capacity.

With such facilities available, the American Foundrymen's association will be in a better position than ever before to co-ordinate all phases of both exhibit and convention sessions. With a broad technical program well under way for papers and reports on interesting and valuable foundry subjects, the 1932 Philadelphia meeting offers exceptional opportunity for a successful and representative convention of the foundry industry.

Moves Chicago Office

Shepard Niles Crane & Hoist Corp. has moved its Chicago office from the Peoples Gas building to 564 West Monroe street. Walter B. Briggs is district manager and G. G. Robbins is associated with him.

Steel Founders Oppose Revision Of Railroad Specification

OPPOSITION to attempts of one railroad to revised upward A. R. A. specifications for class B steel castings was voiced at a meeting of the Steel Founders' Society of America at the Roosevelt hotel, New York, Oct. 22. President W. H. Worrilow, Lebanon Steel Foundry Co., Lebanon, Pa., on motion of John E. McCauley, Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., was empowered to appoint a committee to study the situation further and to strive for united action. The discussion, which developed into probably the most important of the meeting, was led by F. A. Lorenz Jr., American Steel Foundries, Chicago.

Would Increase Yield Point

Proposed revision of specifications would increase the yield point from 36,000 to 38,000 pounds, also raising elongation, reduction of area and tensile strength. Opinion was expressed freely that it was an attempt to secure a better specified casting without additional cost, although doubt was voiced that this was possible. While no change in design was indicated, changes in heat treatment and analysis undoubtedly would follow, meaning additional cost to the producer of steel castings in class B.

Producers of class B steel castings, aiming high to assure a margin of safety against rejections in tests, automatically go over minimum specifications, it was pointed out. With 36,000 pounds as the specified yield point many, as a rule, strive for 38,000 pounds on the average. It is claimed that with 38,000 pounds specified, the margin of safety would be raised to 40,000 pounds, meaning a change in heats and also analysis.

R. A. Bull, director, Electric Steel Founders' Research group, Chicago, stated that while this move toward revision in specifications started with one railroad, it was a move which might spread to other industries using steel castings. He called attention to the aluminum factor in castings and foresaw a desire for something without going into the alloy field.

John E. Galvin, Ohio Steel Foundry Co., Lima, O., declared all attempts should be made to avoid multiplication of specifications and said the action of the society regarding the change in class B specifications was a move in that direction.

G. R. Casey, Treadwell Engineering Co., Easton, Pa., vice president of the society and chairman of the eastern division, presided. In opening the meeting he said steel foundry leaders had become unwilling to accept conclusions offered by economists, public predictors and forecasters in the present prolonged depression—that economists themselves were now chary of rose-hued forecasts, being more conservative and reliable.

G. R. Casey

Regarding the price situation, Mr. Casey said: "We have been preached to about unsound sales policies as regards basing prices on theoretical costs that are far lower than our experience should indicate are possible, and striving for sufficient volume to wipe out undesirable deficiencies of burden carried, and we have agreed in principle with what we heard, but too often persuaded ourselves that our own particular situation at the time was an exception, and, that what we admitted was dangerous as a general practice would not have an injurious effect upon us at that particular time.

"There is no surer path to receivership than disposing of merchandise at prices which do not return at least the monies expended in production of said merchandise."

In nine out of ten instances of 1931 receiverships and mergers in which the weaker unit is absorbed, the submerged unit was busy until shortly before its ultimate receivership, Mr. Casey declared in pointing out the fallacy of volume without reasonable profit.

P. C. Rogers, Roxbury Steel Castings Co., Boston, spoke on "Misinterpretation of Blue Prints and the Effect of Selling Prices," illustrating his address with a group of blueprints to stress his point. Difficulties in estimating on blueprints which do not define pattern equipment clearly often represent the difference between loss and profit, the speaker claimed. It was found necessary in some instances to seek adjustment when bids had been submitted on misinterpreted prints resulting in incomplete pattern information.

Appeals for United Action

W. W. Nichols, Allis-Chalmers Mfg. Co., Milwaukee, made a strong appeal for united action with revised attitude toward the new social order which is growing out of present conditions. Individual prosperity depends upon the success of industry as a whole. Had the early trusts held public service as being first there would have been no Sherman or Clayton laws or acts, the same applying to the railroads. Mr. Nichols declared that industry must play its part in remolding capitalism even to the extent of adopting that which is best and good in the more radical views of the social order.

He is opposed strongly to any and all attempts at price-fixing, comparing it to forcing water up hill and stating the law of supply and demand was as fixed as the law of gravity.

"It can be done, but is not worth the effort," Mr. Nichols declared. "Mistrust soon follows in aggravated form, good will is lost and faith is destroyed."

He urged the exchange of information as to stocks, inquiry and other information but as a co-operative action only for the benefit of all in any particular industry. He declared that industry must play its part in the possible social evolution and play it well with the thought of public welfare first in mind.

In discussions and reports as to operations and bookings, it was reported that a 2.5 per cent increase

in the number of foundries reporting operations over 50 per cent was noted in September as compared with the previous month. In oral reports, supplementing earlier figures, members indicated that not much change was expected in operating rates or bookings during the remainder of the year. Some are operating less than when the formal report was filed and a few slightly higher, but in general the situation as to inquiry, bookings and operations showed little change. September bookings were slightly above those of the previous month.

Sounds Optimistic Note

J. M. Duncan, Detroit Steel Castings Co., Detroit, sounded an optimistic note from the automobile industry, stating that builders of motor cars are planning more expansive programs which should be in operation by the first of the year. He declared the automotive interests are spending and planning for the near future which would be reflected in the steel castings industry. Messrs. Lorenz and McCauley spoke confidently of a gradual improvement in the railroad equipment demand, Mr. McCauley noting some confusion as a result of the recent freight rate decision.

Commenting on low inventories, John E. Galvin, Ohio Steel Foundry Co., declared some foundries had as low as three day supplies of pig iron in the yards and that many would be forced into the market for iron should any sizable tonnage develop in the way of orders. Mr. Galvin stressed the need of restoring confidence among bankers, declaring that the one concrete factor in the present slump was the lack of money going into new enterprise. Until credit conditions are adjusted to allow expansion in new enterprise, he saw little on the horizon which would warrant broad optimism.

W. B. Wallis, Pittsburgh Electric Furnace Co., reported an increase in orders and inquiry during the last ten days, sales in recent months having been largely to gray iron foundries. R. A. Bull, while not depreciating present conditions, claimed the depression in no way approached the seriousness of that of 1893. I. E. Sexton, Roxbury Steel Castings Co., commented on the can industry, stating that branch of the metal trade had not suffered as much as others. Recent early action in announcing tin plate prices for first quarter has resulted in earlier buying on the part of consumers, according to Mr. Sexton.

At the luncheon meeting Col. Willard T. Chevalier, McGraw-Hill Publishing Co., urged more science in merchandising, declaring that as much effort would be made in manufacturing orders as in the manufacture of the product to sell. Many industries are now predominated by production thinking, he claimed.

W. E. Farrell, Easton Car & Construction Co., Easton, Pa., spoke briefly on firm bidding, stressing the importance of adhering to the original price offered after arriving at that price through careful analysis as to costs.

A joint meeting of the large and small castings group was held at the close of the formal sessions, Robert Heisserman, Link-Belt Co., Chicago, giving an illustrated talk on "Sand Handling Equipment in the Modern Foundry." Progress reports also were heard from the cost committee, R. F. Nash, Pettibone Mulliken Co., Chicago, chairman, and the committee on recommendations to designers, R. S. Munson, Atlantic Steel Castings Co., Chester, Pa., chairman. Both final reports will be ready soon.

Reviewing New Books

Worth While Literature Covering Numerous Problems Pertaining To Foundry Practice, Management, Merchandising and Research

Uses of Refractories

Refractories, by F. H. Norton, assistant professor of ceramics, Massachusetts Institute of Technology; cloth; 594 pages 6 x 9 inches, published by McGraw-Hill Book Co. Inc., and supplied by THE FOUNDRY for $6 plus 15 cents postage and in Europe by the Penton Publishing Co Ltd., Caxton House, London, for 30s, postage extra.

The scope of the work is not so inclusive as the title might indicate. The book deals mainly with the fundamental processes involved in the manufacture and use of refractories. Also the descriptions of manufacturing processes have been confined to American practice. Extent to which the field has been covered is indicated by the headings of the 21 chapters into which the work is divided: Literature on refractories; history of refractory development in the United States; refractory clays, minerals and rocks; mining and preliminary treatment of refractory materials; Plastic characteristics and molding of refractory materials; drying; measurement of high temperature; burning of clays and other refractory materials; kilns for burning refractories; melting points of refractory materials; load bearing capacity of refractories; spalling; reaction between refractories and slags or glass; expansion and shrinkage; heat transmission of refractories and insulators; the microscope and its use in the study of refractories; use of X-rays in the study of refractories; methods of chemical analysis; miscellaneous properties of refractories; refractory shapes and special articles; refractory cements and plastics.

A list of references to publications dealing with the same subject is appended to each chapter. In addition a complete list is included of periodicals and other publications which carry articles on refractories. A list of natural minerals with formula, melting point, occurrence, specific gravity and hardness, occupies 20 pages. A bibliography on clays, clays and minerals high in alumina, silica minerals, magnesite and lime, chrome, rare earths, silicon carbide, graphite, and general, covers eight pages and contains 169 references.

Life of McCormick

Cyrus Hall McCormick, by William T. Hutchinson, cloth, 493 pages, 6 x 9 inches, published by the Century Co., New York & London, and supplied by THE FOUNDRY, Cleveland for $5.00, postage 15c extra, and in London by the Penton Publishing Co., Ltd., 416-17 Caxton House, Westminster.

This volume takes up the first part of the life of the famous inventor of the reaper, describes in detail the building of the business which bears his name. McCormick is shown as a shrewd business man and a canny fighter who turned his inventive ability to the service of the farmer without neglecting his own profit. By 1850 he had established a factory in Chicago and was developing methods of machine production, world-wide advertising, and sales probably unexampled at that time in their scope and effectiveness. His life in the period before the civil war was a succession of struggles which brought success and made his name a household word by 1860.

The book is more historical than biographical in nature, and in much of the text the figure of Cyrus is lost completely while the reader is given a picture of the precarious business methods of the first half of the nineteenth century. The chapter, "A Venture in Iron, 1836-46," is one of the most interesting in the latter connection. Seeing in himself a future ironmaster, McCormick at 26 purchased an ore bank and erected a blast furnace. It is said that he came out of the project with "his honor, one slave, a horse and saddle, and $300." The knowledge of business thus gained contributed to his later success.

Moves Institute Offices

Offices of the Gray Iron institute have been moved to 4300 Euclid avenue, Cleveland. Arthur J. Tuscany is manager.

Produces Engines for Automotive, Marine and Industrial Purposes

By Edwin Bremer

IN THE previous article describing some of the molding methods employed in the foundry of the Buda Co., Harvey, Ill., which was presented in the Nov. 1 issue of THE FOUNDRY, mention was made of methods employed in making manifolds, and 4 and light 6-cylinder motor blocks. The present article will deal with the production of flywheels, flywheel housings, gear case covers, heavy 6-cylinder motor blocks and castings for diesel engines.

Molding Methods Are Simple

Since flywheels, housings, and gear case covers are comparatively simple castings, as compared to manifolds and cylinder blocks, the methods of molding also are simple, and follow the practices employed in other foundries making similar work. The castings are made in green sand molds on jolt-squeeze machines, or on jolt-squeeze rollover machines. Flywheels are gated in the center over the hub, and poured through a strainer core.

Gear case covers are flanged and the casting cavity is made flange up in the drag. The green sand core forming the interior hangs from the cope. One core is used in the mold to form an opening through which an extension of the crankshaft later protrudes. The flywheel housing or bell housing contains two brackets on opposite sides of the circumference just above a center line drawn through the diameter, and in addition has an inner flange around one face of the casting. Due to the positions of the brackets and of the flange, the casting is made with the flanged portion in the drag, and the interior of the casting is formed with a dry sand core. The under sides of the brackets also are cored out to give a uniform thickness of metal in the casting.

Molding cylinder heads, while not quite as difficult, is in the same category as cylinder blocks and other tricky castings. Similar to the cylinder blocks, the heads contain a water passage which is formed by a core. To prevent shifting of the core with consequent cutting of the walls of the casting or heavy and light sections instead of a uniform thickness of metal, it must be anchored securely in the proper position which is adjusted within a small tolerance by a jig. The casting cavity is made in the cope flask, and in the same position as it is used on the engine; that is to say with the water connection at the top. The drag forms the compression chambers or pockets which are in the head. The drag also contains several small circular ramup cores which the core rests upon. Chaplets placed in the cope rest on tins on the top of the core, and prevent lifting of the core. The casting is gated along the sides from long runners extending the length of the casting. Branch gates from the runner lead to the cavity. The runners are placed in the drag while the branch gates are in the cope, which also contains the sprue and riser openings located over either end of the runner. A strainer core at the sprue end of the runner assures clean metal into the casting.

Are Dome Shaped

Oil pan or sump castings that form the lower portion of the crankcase may be placed in the same class as the flywheels, gear case covers, etc. as far as molding methods are concerned. The castings are dome shaped with a few ribs on the interior, and the only requirement is

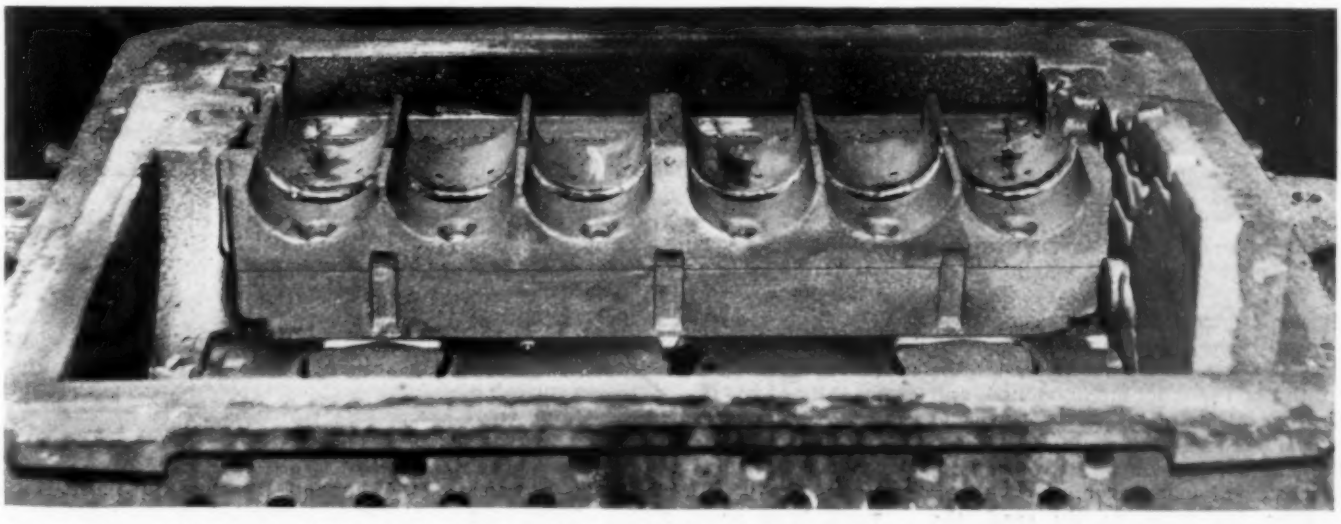


Fig. 1—Drag Mold for 6-cylinder Engine Block with One of the End Cores and Half of the Water Jacket Cores in Place

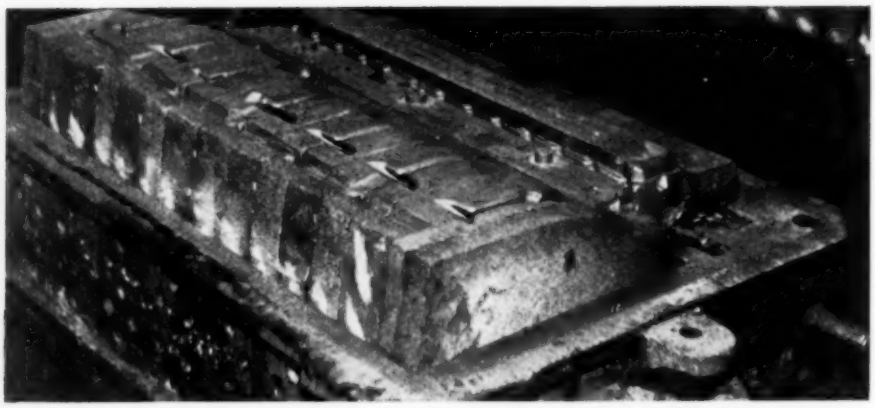


Fig. 2—All the Cores Comprising the Water Jacket and Cylinder Barrel Cores Are in Position

that they will be oil tight. The oil pan castings may be made dome up or dome down, but the least hazardous and easiest way is to make them dome up. Less handling of the molds is involved by that method, and the difficulty of having the green core hanging from the cope is eliminated. With the dome up method, the casting cavity is formed in the cope, and the green core is left on the drag.

Heavy 6-cylinder motor blocks are made on a floor that is approximately in the middle of the foundry. The molding machine is located across the gangway from the floor on which the molds are laid up, and the machine is a jolt rollover pattern draw type supplied by the Osborn Mfg. Co., Cleveland. The machine used differs from those employed for the 4 and light 6-cylinder blocks in that while the mold is being filled, the table holding the pattern and flask is about 12 inches above the floor level. Also, as the machine rolls over, the table rises vertically instead of rolling over on an axis at the rear of the machine. The molds are lowered upon a small car which is pushed under the table in the raised position, and moved away.

Jolt Ram the Sand

With those brief generalities on the molding machine, it may be well to describe in detail the procedure followed in making the molds. The drag pattern for the blocks is attached to the table of the machine, and a flask is lowered into position. One of the operators shovels some facing sand into a riddle held by another operator, who screens it as uniformly as possible over the pattern face. Then both men shovel in backing sand until the flask is filled. Additional sand is heaped on several inches above the edges of the flask. The valve controlling the jolting of the machine is opened, and the operation of ramming the sand continued until the requisite density is attained. The latter is, of course, a matter of experience.

After jolt ramming the sand, the mold is butted off by hand, and the excess sand removed by using handles of the butt rammers as strikes. A few handfuls of sand are scattered over the surface of the mold and a bottom board is rubbed to a firm, even seat. It is clamped into place, and the valve controlling the rollover mechanism is opened. The table and the mold fastened to it begin to rise vertically, and as soon they have cleared the jolt platen, they roll over until the table is uppermost. The vertical movement continues until the lifting cylinders reach the top of their strokes. As those operations are being conducted automatically by the machine mechanisms, the operators push the runout car which is mounted on rails, under the suspended mold.

The valve controlling the lifting mechanism is reversed and the table with the mold descend until the bottom board rests upon the top of the runout car. The clamps now are removed, the vibrator set in action, and the pattern is withdrawn from the mold, slowly at first, until the pattern is clear of the mold, and then rapidly. The runout car containing the mold is pulled from under the machine and the rollover table allowed to return to its normal position to receive the next flask. The production of drag molds is continued until sufficient for a day's work have been made. Then the drag pattern is removed from the machine, and replaced by the cope pattern.

The drag molds are lifted by a crane and transported across the gangway to the pouring floor where they are skin dried. After that operation the cores are placed in position as shown in Figs. 1 and 2. The first cores set in position are two small slab cores which form hand holes in the crankcase. Then the end piece core, placed vertically at the right in Fig. 1, is set in position. That core is followed by one-half of the jacket core for the valve side of the motor, which also is shown in position in Fig. 1. However, due to its intricacy, the half of the water jacket core is made in three pieces, which are set separately.

Barrels Made in Halves

After the water jacket cores are placed, the other end piece is set vertically at the left, and the cores composing the cylinder barrels are set beginning at the right and working to the left. The cylinder barrel cores are made differently than is the usual practice in automotive work. Each barrel or rather barrel and the upper half of the crankcase, is made in two halves; the parting line being at right angles to a line drawn through the center of the row of cylinders, and the lines of demarcation between the various cores may be seen clearly in Fig. 2.

While the barrel cores fit snugly in the space alloted to them, an additional precaution is taken to insure a tight fit. That operation consists in driving a tin, such as is used for chaplet seats on cores, between each pair of cylinders, top and bottom. When the wedging has been completed, the other half of the jacket core, which is in two pieces, is adjusted over the jacket cores already in place. The core setter checks them carefully to see that the cores seat properly, rubs a little core paste on the edges of the joints, and presses the cores together.

When all the cores are in place, the cope is carried to the mold by a crane and lowered into position. The

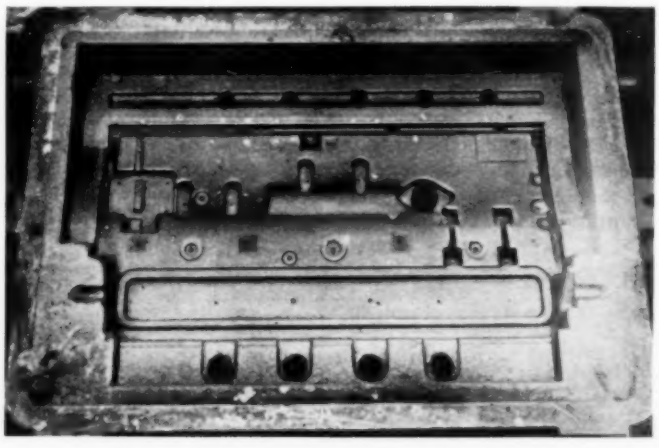


Fig. 3—The Cope Mold Showing the Sprue and Riser Openings

pouring basin for runner cup is made by placing a wooden frame over the sprue openings, and centering a wooden block in the frame. The space between the frame and the block is filled with molding sand and rammed. The block is withdrawn, leaving a basin about 24 inches long, 4 inches wide and 5 inches deep. Four ring cores are set over the riser openings, the mold is clamped and ready for pouring.

The poured castings are shaken out by the night crew, and piled on trucks, which later are taken to the core knockout machine. The latter is an air-actuated, vibratory device which rapidly disintegrates the cores. The sand and most of the core wires fall to the ground. The few remaining wires are removed by hand, and the casting is removed from the machine, placed on a truck, and forwarded with other castings to a rotary sandblast table supplied by the Pangborn Corp., Hagerstown, Md. From the sandblasting department the castings are sent to the chippers and grinders where any small rough spots, fins, are removed and the castings are ground where the gates and risers were attached, etc. The castings then are transported to the final inspection and water test departments where they are examined for variation from the standard allowable tolerances in dimensions, and for water tightness.

Makes Heavy Engines

In addition to producing gasoline engines, the Buda company also makes a line of compression-ignition or diesel engines using heavy oil as fuel. Those are considerably larger than the gasoline engines, and in consequence the method of molding the castings differs from those employed for gasoline motors. Fig. 4 shows a diesel engine ready for shipment while Figs. 5 and 6 show lower half crankcases or oil pans and a cylinder block for a 6-cylinder compression-ignition engine, respectively.

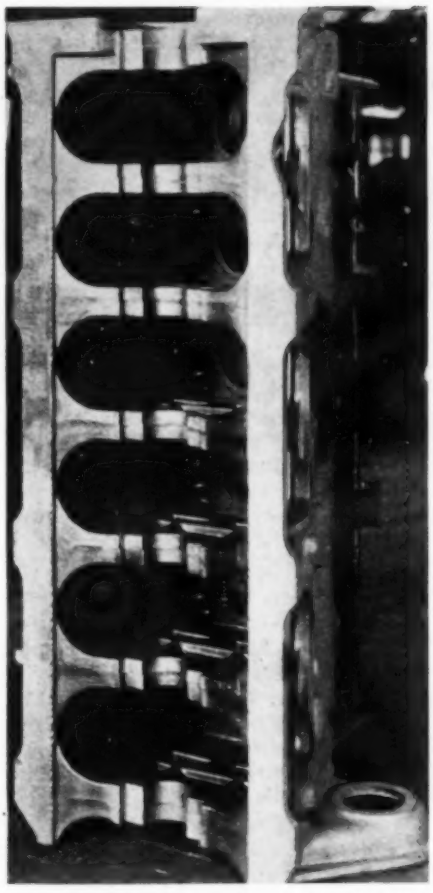


Fig. 6—Block for a 6-cylinder Engine

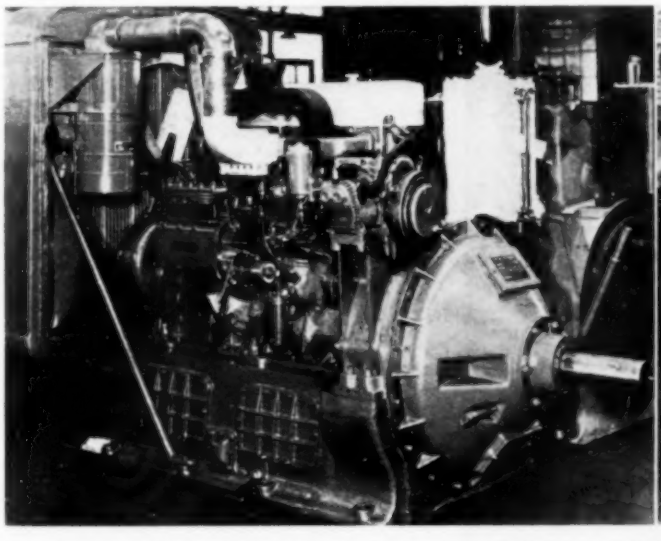
The lower half crankcases are made in large metal flasks with the flange side of the casting up. The practice employed is that usually followed for heavy castings rammed by hand. The pattern is placed on a bottom board and the flask centered over the pattern. Some sand is shoveled into the flask, and it is peened and rammed. That procedure is followed until the flask is filled with sand. Then a bottom board is rubbed into place, the mold and bottom boards are clamped, and the whole is rolled over with the aid of a crane.

The top board is removed and the cope flask placed in position. The gate and riser plugs are placed in position, and the flask is filled with sand and rammed. Then the cope is removed and set aside. The pattern is withdrawn from the drag, and the various cores forming the exterior and interior of the crankcase are inserted. The cores forming the exterior mainly are in the form of slab cores, while those for the interior are rather intricate and contain openings for forming the ribs on the inside of the casting. When the cores are set, the cope is replaced, and the runner basins built over the sprue openings. The cope and drag are clamped carefully together, and the mold is ready to be poured.

Cores Not Complicated

Manufacture of cylinder blocks for the diesel engines is quite similar to methods employed for making gasoline engines, previously described. Castings are made in green sand, which is skin dried. One-half of the casting is made in the drag and the other half in the cope, the centerline being through the row of cylinders. While considerably larger than those for the gasoline engines the cores are not quite as complicated, due to the fact that the valve mechanism is carried in the cylinder head, and no water jacket cores are required. The interiors of the cylinders proper contain several circumferential ribs against which a separate gray iron liner is press-fitted, and the annular space between the liner and the cylinder wall forms the cooling water passage.

The side of the cylinder block at the left in Fig. 6, which corresponds to the valve side of a gasoline motor, is in the drag mold, and is formed largely by dry sand cores. Those



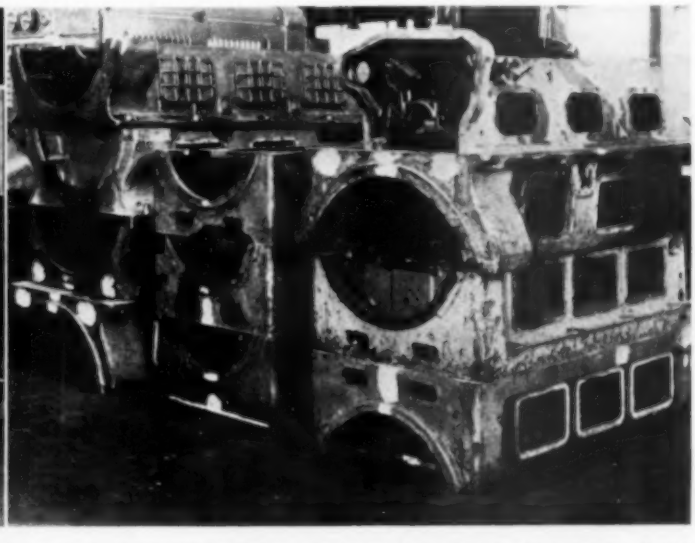


Fig. 4—A 4-cylinder Diesel Engine Ready for Shipment. Fig. 5—A Group of Castings Which Form the Lower Half of the Crankcases for 4 and 6-cylinder Diesels

cores form the handholes, brackets and other projections depicted in the illustration. The cores forming the interiors of the cylinders and the crankcase, are made similar to those for the heavy, 6-cylinder, gasoline motor blocks. That is to say the core for each cylinder is made in two halves with the parting line at right angles to the row of cylinders. Other cores at each end of the cavity give the proper contours on the ends of the casting.

This is the second and concluding article describing methods employed in the foundry of the Buda Co., Harvey, Ill. The first section appeared in the Nov. 1 issue.

THE EDITORS.

Announce Program for N. F. A. Meeting

The annual meeting of the National Founders' asociation will be held Wednesday and Thursday, Nov. 18 and 19, at the Hotel Astor, New York. The session on Wednesday morning will feature the report of President S. Wells Utley, report of Commissioner A. E. McClintock, report of the committee on industrial education by Louis W. Olson, Ohio Brass Co., Mansfield, O., chairman, and a paper "The Modern Trend in Handling People" by A. D. Lynch, director of personnel, Ohio Brass Co. An address, "This Synthetic Age," will be presented by Dr. Gerald Wendt, New York, at the complimentary luncheon.

The following papers will be presented at the Wednesday afternoon session: "The Crisis in Social Policy" by James A. Emery, Washington; "Signs and Portents" by Marc A. Rose, *The Business Week*, New York; "What's on the Worker's Mind in '31" by Whiting Williams, Cleveland; and "Russia, a Menace or an Opportunity" by John L. Lovett, general manager, Michigan Manufacturers' association, Detroit.

On Thursday morning, Maj. R. A. Bull, director, Electric Steel Founders' group, Chicago, will present a paper on "The Selective Application of Castings," and H. L. Hoefman, engineer, Link-Belt Co., Chicago, will speak on "Modern Handling Methods in the Foundry." This will be followed by reports of the finance committee, Carl H. Hoffstetter, chairman, and the resolutions committee, Frank M. Weymouth, chairman. The final business on the program is the election of officers. Henry S. Chafee, Builders Iron Foundry, Providence, R. I., is chairman of the nominating committee.

Institute Shows Gain in Production

A slight increase in production during September, is revealed in the monthly trade report of the Gray Iron Iron institute. Gray iron production which dropped to 48.8 per cent of normal during August, rose to 49.4 per cent in September. While the increase was seasonable, it was not as pronounced as for September, 1929, and September, 1930.

Increased production was mainly in the small foundries up to 100 tons capacity per month. This group showed an increase of nearly 16 per cent from 58.3 in August to 74.2 in September. By districts, the Wisconsin, Illinois and territory west of the Mississippi, led, increasing from 51.7 in August to 54.9 per cent in September. The central states of Pennsylvania, Michigan, Ohio, Indiana and south, remained at the August level of 46.4 per cent while the Atlantic coast states, Canada and the Chicago area showed slight decreases.

Committee Plans Aid

Members of the four national engineering societies, the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, and the American Institute of Electrical Engineers, have organized a committee to help those of their members and other professional engineers who are in need because of unemployment.

The function of the committee is to find employment for professional engineers and to give financial aid to those in actual need of relief. The committee is headed by H. de B. Parsons as chairman, and functions through an executive committee, of which John P. H. Perry is chairman, a finance committee, and a relief committee. Mr. Parsons, a civil engineer of 26 Beaver street, New York, is a professor emeritus of Rensselaer Polytechnic institute. Mr. Perry, a civil engineer, is vice president of the Turner Construction Co., Chicago. Headquarters are in the Engineering Societies' building at 29 West Thirty-ninth street.

Alfred Fisher Furnaces Inc., 1235 Fifty-second avenue, Cicero, Ill., has appointed Herbert C. Beik, 21 East Fortieth street, New York, its representative in the eastern states.

Awarded Safety Trophies

FOUNDRIES were well represented among the industrial groups awarded trophies for safety work at the National Safety congress in Chicago recently. In addition to the ten foundries which were reported as receiving awards on page 46 of the Nov. 1 issue of THE FOUNDRY, the Driver-Harris Co., Harrison, N. J., won first prize in group B of steel plants. The Driver-Harris Co. reported 464,300 man-hours worked with no lost time accidents.

The accompanying illustration shows a group to which trophies and certificates were presented. Left to right: R. A. Beyer, Central Tube Co., Ambridge, Pa.; J. A. Coltrain, National Radiator Corp., Johnstown, Pa.; J. C. Bilek, Driver-Harris Co., Harrison, N. J.; Dr. R. C. Engel, Corrigan, McKinney Steel Co., Cleveland; C. W. Bergquist, Western Electric Co., Chicago, holding plaque awarded to Whiting Corp., Harvey, Ill.; W. A. Gimbel, General Electric Co., Philadelphia works; John M. Turnbull, Kensington Steel Co., Chicago; A. I. Lynch, Ohio Brass Co., Mansfield, O.; G. W. Corkan, Beaver Falls, Pa., plant of Union Drawn Steel Co. unit of Republic Steel Corp.

Questions & Answers on FOUNDRY PRACTICE

THIS department covers all problems relating to metallurgical, melting and molding practice encountered in making steel, malleable-iron and gray-iron castings. Questions submitted by bonafide subscribers to this department will be answered by members of the editorial staff of The Foundry, supplemented where occasion requires by the advisory staff whose personnel is as follows:

John H. Hall
Cast Steel

H. A. Schwartz
Malleable Cast Iron

J. W. Bolton
Gray Cast Iron

All questions must be addressed to the Editor, The Foundry, Penton Building, Cleveland.

GRAY IRON

Make Cast Welding Rods

Can welding rods be manufactured in the foundry, or is only drawn rod used for that purpose?

Rods for welding cast iron often are made of that material, but in many cases low carbon steel or wrought iron rods are employed. Sometimes the drawn rods are coated with materials that will give a weld with the desired characteristics. A mixture of carbide of silicon and graphite applied to wrought iron rods was found to give a weld similar to cast iron being welded, according to a Japanese investigator. If you desire to make cast iron welding rods for use on gray iron, the following composition is suggested: Silicon, 3.0 to 3.5 per cent; sulphur, 0.100 per cent maximum; phosphorus, 0.50 to 0.70 per cent; manganese, 0.50 to 0.75 per cent, and total carbon, 3.0 to 3.5 per cent.

Q & A

Castings Show Porosity

A typical analysis of the iron we are melting shows: Silicon, 2.40 per cent; sulphur, 0.09 per cent; phosphorus, 0.56 per cent; manganese, 0.53 per cent. We find that this iron is quite satisfactory for stove plate, warm air furnace parts, water fronts and small sections of hot water boilers, but on the larger sections there is a great deal of porosity. We shall appreciate your opinion on the cause and prevention of this trouble.

The analysis given is quite suitable for the line of castings indicated. The silicon is a little high for the heavier sections, but if—as we assume—the volume and character of the work do not justify making up charges varying in analysis, the regular mixture of iron you are running should prove satisfactory in all the castings. A close check on the coremaking and molding materials and methods will disclose the cause of the porosity. Any factor that promotes a commotion in the iron before it solidifies in the mold, will result in one or more porous areas in the casting.

The cores may be too hard, too tight, not sufficiently dried. Channels for the escape of the vent may be too small, or may be plugged. The molding sand may be responsible, either on account of its lack of permeability, the manner in which it is prepared, amount of moisture or the manner in which it is rammed. Any or all these factors may be responsible and only can be discovered by a close check all along the line.

We suggest you commence investigating at the core bench. On the larger cores it is quite within the range of possibility that the coremaker is adding some molding sand to what should be a straight sharp sand mixture, with a view of making the core hold its shape in the green state. An addition of molding sand effects this purpose admirably, but unfortunately it reduces the permeability of the core and as a result the gas that should follow the vents provided for that purpose, breaks through the skin here and there and causes an ebullition in the iron in that vicinity. The boiling action ceases in a short time, but the effect remains in the form of a porous area in the casting. If the porosity shows up in the area occupied by the gates, it is evidence that the gates are too thick, or are attached to a runner that is too thick and therefore acts as a sucker instead of a feeder. This point is covered in the Sept. 15 issue of THE FOUNDRY, in No. 17 of a series of articles on gates.

GENERAL

Identify Defect Causes

Can you give any information on causes of pitting, honeycomb, blowholes, etc., in iron and steel castings? Also what methods are used in testing iron and steel and how can the different irons be distinguished? Can you give me a list of books which describe the factors enumerated above?

The defects you mention, provided we interpret them correctly, are caused through improper sand conditions. Pitting may result from dirty molds in which particles of sand are washed to various places in the mold, and lodge on the surface of the casting. It also may be caused by the sand being too dry or too wet particularly around the gate. Such sand is washed away easily, and carried along with the metal stream. Honeycomb may result from core blows, from wet sand or hard ramming, or it may be caused by shrinkage resulting from improper gating or feeding. In the latter case there is no connection between the honeycomb portion and the exterior of the casting. Blowholes, as the name indicates, are caused by gas or steam blowing into the metal from improperly vented cores, wet sand or hard ramming. Sometimes they are caused by pieces

of dirty scrap metal, chunks of wood, or small balls of clay at, or close to, the surface of the mold. When the hot metal or the heat from it strikes them, gases are errupted which kick back into the metal.

In addition to chemical tests to determine the compositions of irons and steels, a variety of tests to determine the physical properties are employed. Those include tensile strength, transverse strength, hardness, impact resistance, fatigue, etc. The tensile strength determination is used mainly on steel while the transverse test is applied to gray iron. Presumably your reference to distinguishing the different kinds of iron used means pig irons. That is a rather difficult problem at present due to the use of chill pig molds, etc., at the blast furnaces which change the cooling conditions of the molten metal. Perhaps with experience, you might be able to distinguish the various grades, but we would hesitate to rely upon anything except chemical analysis.

A number of books are available that undoubtedly will be of assistance to you in learning more about gray iron and steel casting, and we suggest the following: Hall—*The Steel Foundry;* Moldenke—*Principles of Iron Founding;* Hurst—*Metallurgy of Cast Iron,* and Hartley—*Elementary Foundry Technology.* Any of the books may be purchased through the book department of THE FOUNDRY.

Problems in Nonferrous Founding

By Charles Vickers

Gives Melting Points

We would like to obtain the melting points and pouring temperatures of some nonferrous alloys.

Naval brass containing 61.50 per cent copper, 37 per cent zinc, and 1.50 per cent tin melts at 1570 degrees Fahr. Manganese bronze composed of 60 per cent copper and 40 per cent zinc with some manganese, iron and aluminum melts at 1600 degrees Fahr. Yellow brass containing 67 per cent copper, 31 per cent zinc, and 2 per cent lead melts at 1645 degrees Fahr. Red brass consisting of 85 per cent copper, 5 per cent zinc, 5 per cent lead, and 5 per cent tin melts at 1780 degrees Fahr. Bearing bronze containing 80 per cent copper, 10 per cent tin and 10 per cent lead melts at 1735 degrees Fahr. Gun metal with 88 per cent copper, 10 per cent tin, and 2 per cent zinc melts at 1825 degrees Fahr. Aluminum bronze containing 90 per cent copper and 10 per cent aluminum melts at 1908 degrees Fahr. Phosphor bronze with 90 per cent copper and 10 per cent phosphor-tin melts at 1885 degrees Fahr. The No. 12 aluminum alloy containing 92 per cent aluminum and 8 per cent copper melts at 1150 degrees Fahr.

The pouring temperature of naval brass, manganese bronze, and yellow brass may vary from 1850 to 2000 degrees Fahr. The pouring temperature of aluminum ranges from 1250 to 1350 degrees Fahr., and always should be held as low as possible. Aluminum bronze is poured at from 2000 to 2200 degrees Fahr., but rarely higher for sand castings. The pouring temperature of a phosphor bronze may go as low as 1900 degrees, but it is not advisable to go lower, and often it is higher depending upon the alloy and the type of casting. The remaining alloys are poured from 2050 to 2250 degrees Fahr. depending upon the type of casting. Castings to withstand pressures should be poured hotter than those that do not have to resist pressure.

Q & A

Black Specks Appear

We are making thin brass castings which machine freely, and apparently are perfectly clean coming from the sand, but after being polished the surface of the castings are covered with tiny black specks. We melt the metal in an electric, direct arc furnace and pour at 2100 degrees Fahr.; adding 2 ounces of 15 per cent phosphor copper as a deoxidizer to the alloy which is secondary ingot of the 85-5-5-5 composition. Do you think there is any possibility of silicon reduction from the sand adhering to the sprues and gates charged, or from the lining which is a special one made for the furnaces?

Under a magnifying glass the spots appear angular, and look like holes filled with polishing compound. However, examination of the fractured edge shows that entire metal is filled with the same type of black spects. The specks look as though carbon dust had been mixed thoroughly with the metal, but carbon is not that soluble in brass. If the holes were caused by gas, they would not be filled with the black substance in the interior of the casting. Therefore, it appears as though some finely divided material has been mixed with the metal.

Just what it is, is hard to say, and the simplest way of getting rid of it, is by a process of elimination. The first thing to work on will be the ingot metal. Use a new source of supply, or all new metals without any of the old sprues or gates. If the trouble continues, the ingot is not at fault. Then try melting the metal in a different furnace, electric or crucible, etc. If the trouble still continues, investigate your molding sand and molding methods.

While there may be a possibility of silica reduction in your furnace, there does not seem to be any evidence of such reaction.

Q & A

Calcium May Be Cause

We find trouble in making small brass castings as they contain many gas holes. The mixture is made from new metals, using electrolytic copper with zinc, tin and heavy lead scrap. The latter is the only old metal entering into the composition. It is peculiar this trouble does not occur regularly, for two or three heats will be satisfactory, the next will be bad. Our foundry methods have not been changed, as we have same force as always.

The casting is a squat, square knob or ornament having its top cut to a diamond shape, and this part is molded in the drag, and comes sound for no blemishes show on machining. The cope side carries a core that makes a hollow in the head of the casting and leaves two opposite prongs that are presumably bent over for attaching the knob. These prongs and the flat border around them are the scene of the porosity.

The surface left by the core is peculiar, being a dead lime white color. The same coating also can be detected inside of many of the blowholes by the magnifying glass, so the trouble likely is caused by some coating put on the core against which the metal will not lie but kicks and sputters enough to pass gas into the surrounding metal border. It may be something added to the metal. If calcium had been used as a deoxidizer the conclusion would be that at times too much is used. A small amount only is required.

Our suggestion is to use only regular plumbago for coating the cores, which can be obtained from advertisers in THE FOUNDRY. Use nothing else as a coating, and in setting the cores have the prints long enough to hold them securely without the necessity of packing the sand around them too densely, as it will blow and cause such holes. As far as the scrap lead is concerned it may contain antimony and arsenic, and while, if either of these are too high they will cause endless trouble in high leaded alloys, in the case of the metal we are discussing, no trouble from such metals can be expected. It looks as though someone had attempted to use one of the so-called deoxidizers containing calcium, and we counsel its abandonment, as evidently it is not correctly made and applied.

Prevent Losses With Proper Gates and Risers

By Pat Dwyer

ABOUT 2 years ago, to be exact Jan. 15, 1930, a question and answer dealing with a shrinkage defect appeared in THE FOUNDRY. This subject is a hardy perennial and is taken up at present, because the particular point under discussion prompted an illuminating comment from a prominent British foundryman. The theory he advances is interesting and plausible and is commended to the attention of readers who may have been, are now, or who in the future may be confronted with a similar problem. The original question and answer follow:

Proposes a Remedy

We are enclosing sketch of a hydrant foot casting which is causing us considerable trouble on account of a *draw* which always appears in the heavy section market *A* (Fig. 113). We have to weld a crack 2 inches in length, ½-inch wide. How can we prevent a repetition of this annoying defect?

You do not state in what position the casting is poured, but we assume from the sketch that the casting is shown at the parting line in the pattern and that the casting is made in the usual manner in a two-part green sand mold, with a dry sand core, with one-half of the mold in the drag and one half in the cope. The dry sand core rests on two prints and on a single chaplet placed at a point below the intersection of the center lines as shown on the sketch. A similar chaplet is placed on the cope side to hold the core firmly in place. The sprue and runner probably are placed in the open space in front of *A* and a gate is cut into each branch of the mold. Under the foregoing conditions, the position of the gate is a contributory factor to the shrinkage crack. The hottest iron is suppiled at a point where it least is needed, at the thickest and heaviest part of the casting.

Theoretically, the iron should be poured into a casting in a manner to equalize the cooling speed all over. While this rarely is possible in its entirely, still in many instances the gate can be placed in a position to approximate the desired result. In this particular instance the iron could be poured either at the opposite side of the mold, or, through a small pop gate on top.

The most logical method for curing the trouble is to equalize the casting thickness either by removing some material from the outside of the pattern at the dangerous area, or to add some thickness to the core at a corresponding point on the inside. If this cannot be done, for any one of various reasons, then temporary relief may be secured by using a chill in the mold or core at the affected point, or, by sticking two or three big head nails in the sand with the heads projecting into the mold cavity. They will help to cool the iron and thus prevent it from *drawing* later.

Stress Need of Vent

INTERESTING incident is quoted to show how a vent passage strategically arranged, cured a defect of long standing and one that had been blamed on a variety of causes. The quotation confirms a point that has been stressed throughout the entire present series of articles, the necessity of providing free egress for gas and steam from the sand, particularly bodies of sand partially or almost surrounded by the metal filling the mold. A great deal of useless experimenting and idle theorizing might be avoided, with a consequent turning of the time to better advantage, if this primary and highly essential feature constantly was kept in mind. Excerpts from a British exchange paper go to show that a change in the metal composition frequently is all that is required to clear up cases of porosity and shrinkage.

Suggests a Vent

Publication of the foregoing elicited the following interesting comment from R. O. Patterson, managing director Smith & Patterson, Newcastle-on-Tyne, England:

I had this same trouble a few years ago and it was cured by ramming a perforated pipe practically in the position occupied by the arrow in the sketch (Fig. 113). The idea came to me from a paper presented by E. V. Ronceray in Newcastle about that time. His argument was that there is no such thing as a *draw*. All the defects usually classified under that term are caused by *blows* from the sand.

The idea was revolutionary so far as I was concerned and in direct opposition to all foundry tradition. However, having tried every orthodox method in vain, I decided to give the new idea trial and had no more wasters on that job. On several occasions since that time, I have utilized the same idea and it never has failed.

Mr. Ronceray's argument is that when a projecting body of sand, particularly green sand, is surrounded rapidly by molten metal the gas or steam cannot escape quickly enough. Some of it is forced through the metal. Two of the remedies suggested in THE FOUNDRY, a core or a chill, probably will answer the purpose, but I do not favor the use of nails. They may serve to hide the defect, but I think that if one were to break the casting, he would find a defective area.

Study Open Molds

This serves to confirm a point that has been stressed throughout the entire present series of articles, the necessity of providing free egress for gas and steam from the sand while the metal is filling the mold. A great deal of experimenting and theorizing might be avoided if this primary and highly essential factor constantly was kept in mind.

Man is a reasoning animal, but in the majority of instances he needs a tangible object lesson to spur the reasoning faculty into action, or to accelerate the process if the mind already is on the trail. For that reason the apprentice or beginner in the foundry should be given a course in open sand molding under the direction of a teacher competent to explain the curious phenomena to be observed in the behavior of the molten iron as it comes into contact with various parts of the mold.

Practical demonstration of this kind, properly interpreted will do more to develop the pupil's reasoning power, his ability to diagnose subsequent defects, than almost any amount of oral instruction by itself.

Occasionally while feeding a cast-

ing the foundryman is astonished to find the metal backing up through the riser, instead of sinking in the ordinary manner. Since this clearly is a violation of the law of gravity, it is apparent that some extraordinary influence, some force of which he has no conception, is at work inside the mold. The point is touched upon here because if metal is exuded from a casting instead of imbibed during the shrinkage period, it is apparent that the casting will not be solid.

The foregoing does not refer to instances where the metal is ejected violently. That phenomenon is due to mold conditions. Steam or gas developed in large volume and denied legitimate outlet, forces its way through the riser and incidentally

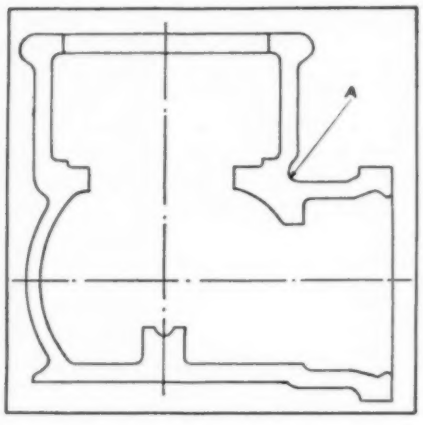


Fig. 113—A Crack or Draw Usually Appeared in the Castings at Point A

forces some of the metal with it. The exhibition is somewhat spectacular and the cause is so obvious that the foundryman has no difficulty in reasoning from effect to cause. Frequently also, after the volcano has subsided the foundryman may salvage the casting by pouring fresh iron through the gate or directly down through the riser.

In the first instance the metal oozes up quietly and flows over the edge of the riser. The following explanation was presented by R. H. West, West Steel Casting Co., Cleveland, in the Sept. 15, 1928 issue of THE FOUNDRY:

There must be one of two causes for this trouble, either the metal or the sand. If the sand is not right, that is, if it is too wet or too hard, it would cause a violent commotion and result in a decided *blow*. I am inclined to the opinion that the trouble is with the metal. The foundryman should examine his iron thoroughly for oxidation. To test out this theory he might use an extra amount either of fine ferromanganese or some aluminum alloy as a deoxidizer. With exceedingly hot metal, this material may be added to the metal in the ladle while the stream is running from the cupola spout. Under other conditions the material may be charged in lump form, directly into the cupola with the pig iron and scrap. Lump spiegel added to each charge would supply a good practical solution to the problem. The trouble also may be caused by skimping on limestone to such an extent that the cupola is not fluxed properly.

While on the subject of risers and shrink heads the following extracts from a paper presented by Frank Hudson before the American Foundrymen's association in Chicago, April 8-11. 1929, may be introduced with propriety since they bear directly on the points under discussion. The paper in two parts was published in the Aug. 1 and Aug. 15, 1929 issues of THE FOUNDRY. It was the annual exchange paper presented on behalf of the Institute of British Foundrymen and is highly recommended to readers interested in the composition of the iron, cupola operation, carbon control, pouring practice and other factors governing the production of sound castings.

**** Besides bearing on quality, the composition of the iron has an important part to play in producing castings free from defects. The defect most troublesome to the average founder is shrink holes. This is of particular import when castings are subject to a pressure test.

**** Solidity of gray iron castings is determined by several factors, metal composition, pouring temperature, method of molding, design, etc., and of these, composition has an important part to play. Especially is this the case where badly designed jobs are on hand, and it is peculiar that many important castings, locomotive cylinders, valve bodies, etc., are the biggest offenders in respect to the composition of the metal.

When a casting leaks under test and the practical man has his suspicions of the presence of porosity and shrink holes, he either thinks the metal is too hard, or else decides to put a riser or some sort of feeding head on the spot.

Softening the metal probably will make matters worse. Extra heads and risers increase the weight of metal required for the job.

Consider Two Examples

Dealing in detail with two typical instances a hydraulic valve body and a locomotive cylinder the author claimed that a change in the iron mixture eliminated all tendency toward shrinkage, porosity and leakage under pressure test. Large risers, formerly considered necessary were used no longer and the castings now are molded in a much more convenient position. Reference to the paper is introduced here as a possible life line for the foundry swimmer or investigator who has been concentrating all his effort on gates and risers in an effort to save a casting affilicted heavily with shrink spots and porosity.

Extended reference to the purely metallurgical features lies outside the range of the present discussion, but the following additional extracts from Mr. Hudson's paper are commended to the attention of all those seeking light on the cause and prevention of defects in castings directly and obviously traceable to the changes that take place while the metal is passing from the molten to the solid state:

Other instances can be cited from various technical proceedings and transactions. For instance, Smalley in the proceedings of the Institute of British Foundrymen, 1922-1923, gives examples of obtaining greater solidity in sluice valves, and the displacement of chills on unequaled sectioned metal at the valve faces, by a revision of composition. The reason for obtaining sounder castings by the use of correctly compositioned mixtures is explained by the work

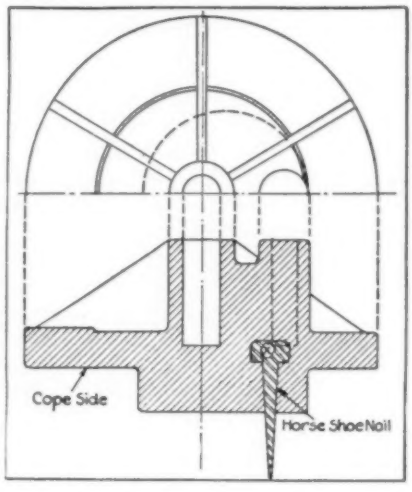


Fig. 114—Suggested Application of Horseshoe Nail To Prevent Shrinkage

of Smalley, MacKenzie, Bolton, and others.

All shrink-holes and porosity are formed during the freezing or setting period of the molten iron in the casting, and the composition determines the length of this period. The softer the iron, the greater the freezing period, and the harder the iron becomes then the less is the freezing period. It is obvious that the smaller this range, the likelihood of porous castings being produced is correspondingly reduced. Casting temperature, type of mold used, molding methods, and cupola operation are all bound together for success and these will receive consideration later in the discussion.

By reducing the total carbon, silicon, phosphorus and manganese, and by increasing the sulphur, an iron with the lowest freezing period is obtained. However, this would not be good practice used indiscriminately. Trouble certainly would arise due to lack of fluidity, and hard castings would be produced. The bulk of the information on hand relative to this question suggests that the manganese and sulphur should be constant around 1.0 per cent manganese with the sulphur not exceeding 0.10 per cent, and the necessary variations made in the other elements. In the

author's experience it has been found that for high class work the total carbon content should not drop below 3.0 per cent and for cylinder work, having variation in section, an increased amount of total carbon up to 3.5 per cent is desirable.

The present-day tendency for total carbon contents below 3.0 per cent is not essential to general foundry practice, and leads to difficulties. The important part total carbon plays in the solidity of castings unquestionably is hinged upon the cooling rate and casting section. With the same cooling rate and casting section an increase in the total carbon content brings about liquid expansion, which in conjunction with a composition of short freezing range is an invaluable help for obtaining solid castings having varying section in their design. However, the use of high total carbon mixtures and the consequent increase in graphitic carbon demands that low phosphorus contents be used to obtain satisfactory toughness and good results.

A puzzling type of defect that sometimes appears in small castings is typified in the illustration Fig. 114. Despite the most earnest effort at prevention the casting will show a hole or shrinkage cavity at the point marked *X* after the small hole to the right has been drilled. The hole to the left is cored and the casting is poured from a good gray iron mixture.

Due To Different Causes

A close examination of the defect and a knowledge of all the factors involved in the production of the casting are required to determine whether the defect is a blow hole, a shrink hole or a combination of both. An investigator familiar with the generalities of foundry practice will be inclined to place the blame on the last of the three. Usually a man can determine the point to his own satisfaction by making three or four experimental castings under different conditions.

Assuming first that the defect is a combination shrink and blow hole, the cause may be found in an unvented mold or core and a low pouring head. Unless the sand is extremely open it will cause the iron to boil slightly on account of the brackets which form the sand into pockets. Some of the steam and gas may escape, but enough remains trapped in the solidifying iron to form the defect shown in the illustration. The small core in the hole to the left may be too hard and tight for the gas to escape downward readily. Some of the gas may come through the top and remain in the iron. Finally the pouring head may be too low to exert sufficient pressure to form a good, solid casting.

The remedy for the condition is obvious. The sand should be worked as dry as possible. In a first experiment a vent wire might be used in the pockets with beneficial result. A perforated bottom board should be used or the sand should be scored on the bottom and clearance should be allowed between the lower edge of the drag and the face of the bottom board. In more than one instance a tightly fitting bottom board has been found to be responsible for all the trouble. The small center core should be made from a weak oil sand mixture without any addition of bank sand. Any cope 4 inches or less in height should be surmounted by a pouring cup that will insure at least a 6-inch head.

Keep the Riser Open

If the defect is purely a shrink hole due to the composition of the iron it can be prevented or mitigated by the insertion of one or two horse shoe nails as shown in the illustration. The nails should be clean, without any trace of rust or dampness on the surface.

Risers or feeders in one form or another are essential on some castings. In many instances, as pointed out previously in this series, risers or feeders are unnecessary. Men have placed them without any clear idea of what function they serve and merely through habit. However, where a riser can be placed to advantage it serves a useful purpose in supplying liquid metal to compensate for natural shrinkage in volume.

Clearly, unless the metal in the riser remains liquid for as long a time as the metal in the casting, it does not fulfill its anticipated function. A material recently placed on the market by a prominent manufacturer in the foundry field is claimed to possess the ability of raising the temperature of the metal in the riser to a point that will insure a liquid condition far beyond the ordinary limit. Exceedingly hot metal in the riser should keep the channel of communication open between riser and casting until solidification of the casting takes place.

Considers Research in Farm Equipment

Farm equipment credits and research were important subjects considered at the thirty-eighth annual convention of the National Association of Farm Equipment Manufacturers in Chicago, Oct. 21-23, at which reassuring prospects for the future were sensed.

H. G. Newcomer, Eureka Mower Co., Utica, N. Y., retiring president of the association, pointed out that the history of the farm equipment industry records numerous periods of depressed volume, and that each of these has been followed by spirited demand. The question of price reductions for farm equipment was not taken up officially by the convention.

A few tractor plants are operating on better schedules, and considerable production for inventory has been laid aside for winter operations. Stock inventories are less of a problem. Further liberalization of credit terms was advocated by some manufacturers, while others took the view that further extensions of long-term credits would be detrimental to the industry.

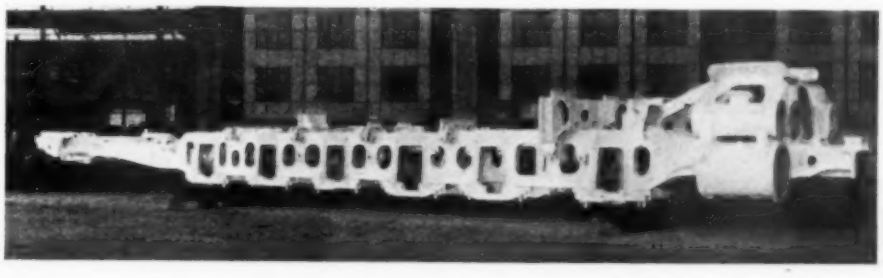
Appointed Sales Agent

Ray C. White has been appointed eastern representative, Electric Furnace Co., Salem, O., in charge of both electric and fuel furnace sales for northeastern Pennsylvania, eastern New York and New England with headquarters in New York.

Production of malleable castings in September totaled 18,161 tons compared with 18,531 tons in August and 26,528 tons in September 1930. New orders decreased from 18,494 tons in August to 17,595 tons in September.

Cast Steel Frame Made in One Piece

THE one piece cast steel locomotive frame, a development of recent years, represents probably the highest mark yet attained in solving problems incident to the steel foundry. In addition to its great length—up to 60 feet—the casting presents great variations in shape and metal thickness. Method of molding and casting these frames was developed at the plant of the Commonwealth Steel Co., Granite City, Ill., now a part of the General Steel Castings Corp., with a new plant in Eddystone, Pa. The mold is formed entirely in dry sand cores assembled on an incline inside a cast iron frame machined accurately to size and provided with clamping devices.



Furnace Manipulation *Governs Inclusions in* Acid Open-hearth Steel

By C. H. Herty Jr. and J. E. Jacobs

FOR the past five years, the United States bureau of mines, in co-operation with Carnegie Institute of Technology and the metallurgical advisory board, has been engaged in the study of the physical chemistry of steelmaking, with particular emphasis on the basic open-hearth process. In February, 1930, a co-operative agreement was made between the United States bureau of mines and the Heppenstall Co., Pittsburgh, to study the acid open-hearth process, with particular emphasis on the oxidation and deoxidation of the steel. Such a study necessarily involves all phases of steel melting in the acid furnace.

Study Six Major Factors

At the outset of the investigation, it was decided to study six major factors in the production of acid steel, and two grades of alloy steel of the percentage analysis shown in Table II were chosen for the investigation. The six factors to be studied were: Elimination of nonmetallic matter originating in the charge and from the furnace lining; oxidation of the metal during the working of the heat; deoxidation with ferrosilicon and ferromanganese and with special manganese-silicon alloys; elimination of silicates in the ladle; segregation of nonmetallic matter in the ingot; and slag-metal reactions. The experimental work is being carried out in 20-ton furnaces. The average weight of metal tapped is 57,000 pounds. The hearth is 18 feet long and 7 feet wide, and the furnace is oil-fired.

The first four items have been studied in detail, and work is being carried out on the latter two items. A further study is being made in connection with item 6 or the oxidation of the metal. Only a trace of phosphorus and no sulphur are eliminated in the acid open-hearth process. This necesitates careful selection of materials to be used in the charge. Carbon is oxidized readily and is controlled according to the type of product to be made rather than by any limitation of the furnace. The charge is made to contain about 0.75 per cent. The length of time necessary to melt an all-cold charge varies from 3 to 5 hours, depending upon several factors. When the charge is melted, the bath contains an average of 0.15 to 0.25 per cent silicon and 0.15 to 0.30 per cent manganese. In addition, there usually is present 0.50 to 0.75 per cent carbon in excess of that required in the finished product.

Table I presents two typical slag analyses at melt-down and other data.

The reactions underlying the elimination of carbon silicon and manganese are well understood and require no elaboration. After the residual manganese and silicon have been reduced and the proper temperature has been attained, the steel is ready to be refined. There are arguments both pro and con concerning the merits of using appreciable amounts of ore during the working period. The general practice in this country has been to use small amounts of ore.

Follow Heats Through Process

The procedure used in this investigation was to follow heats from the time the furnace was charged until the steel was poured. The analysis of the charge was known from a previous knowledge of the materials charged. Metal and slag samples were taken at definite intervals until the heat was ready to be deoxidized, just before deoxidation, at definite intervals between deoxidation and tap, and metal samples were taken on the pouring platform. Iron oxide in the metal was determined by the aluminum method, as described in technical publication No. 311, American Institute of Mining and Metallurgical Engineers. The visible nonmetallic content of the steel was ascertained by the inclusion-count method given in co-operative bulletin 38, U. S. bureau of mines, Carnegie Institute of Technology, and the metallurgical advisory board. Slag viscosities were taken by the inclined-plane method as described in co-operative bulletin 47, U. S. bureau of mines, Carnegie Institute of Technology, and the metallurgical advisory board, and *Transactions*, American Institute of Mining and Metallurgical Engineers, Iron and Steel division, 1929.

Due to the difference in opinion of various operators concerning the amount of ore to be used during the working period, this investigation includes heats which were worked with

Studies Formation

ALTHOUGH this article deals with the elimination of inclusions in steel through improved furnace manipulation, the method of formation, size and causes of those inclusions are given. The addition of ore and deoxidizers have certain effects which are described but inclusions also come from the bottom materials. Methods of elimination all hinge on the formation of large inclusions that will rise to the slag with ease. The addition of spiegel immediately before the ore, is conducive to that condition. Extremely clean steel was obtained by the use of a special deoxidizer developed by the U. S. bureau of mines. The article, which is abstracted from a paper by the authors at the Western Metal congress held in San Francisco, also discusses other phases of deoxidation and explains the relation that exists between slag and metal. The authors are physical chemist, Pittsburgh experiment station, U. S. bureau of mines, and research metallurgist, the Heppenstall Co., Pittsburgh, respectively.

no ore addition; with small ore additions; and with relatively large ore additions. From a theoretical point of view it seems reasonable that a large ore addition would be most advisable. After the silicon has been oxidized, a large number of small glassy silicate particles exist in the bath. To aid their transfer from the metal to the slag, some action must take place, and the most logical agent to produce this action is an ore boil. For this purpose, large, lump ore is best because it causes a much more violent boil than small ore. On heats which melt low in silicon, a vigorous action commences as soon as the heat is melted. These heats require less ore to obtain the desired action than those melting higher in silicon.

Oxides Form Larger Particles

In addition to the vigorous action in the bath, there is another factor that facilitates the removal of these silicate particles, and that is a fluxing agent. As the rising velocity of a particle of nonmetallic matter in the steel bath is proportional to the square of its diameter, the larger the particle the more rapidly it will rise out of the steel bath and enter the slag. For that reason it would seem advisable that some oxide such as MnO be formed in the bath at the time of the ore addition. The oxides SiO_2, MnO, and possibly some FeO then would combine, form large globules, and have a much greater tendency to rise to the slag during the boil than would the small SiO_2 particles alone. Following this line of reasoning, a spiegel addition of approximately 50 per cent of the weight of the ore was added to the bath just before adding the ore. Part of the manganese in the spiegel forms MnO in the bath when the ore is added and acts as the fluxing agent.

The advantage of using ore and spiegel was shown clearly and on two of the heats worked in that manner, there was no visible nonmetallic matter one hour after the ore addition.

About 1 to 1½ hours after the ore addition, the steel begins to *dirty up* again. From all indications it would seem that this increase in nonmetallic matter comes from bottom materials. The types of inclusions are exceptionally small and high in silica. As there is little silicon in the bath which can be oxidized to SiO_2, it seems impossible that this material could come from that source. This would indicate that the various grades of sand used for bottom material and the methods of burning in the bottom affect the cleanliness of the steel during the working period. materially.

Numerous data showing the oxidation of the steel in basic open-hearth furnaces have been published by one of the authors in connection with the work on the physical chemistry of steelmaking. To the best of their knowledge, only one oxidation curve has been given for acid open-hearth work. Therefore, one of the essential factors of this investigation was a study of the oxidation of the bath and the factors controlling it. On all the heats, iron oxide in the metal was determined by the aluminum method. As would be expected, the oxidation of the heat increases as the carbon drops, although this is not as pronounced on high carbon as on the low-carbon heats. Factors affecting the oxidation of the metal are carbon content; slag composition; slag viscosity and temperature.

In basic open-hearth practice the iron oxide content of the metal seldom decreases unless a deoxidizer is added. On the other hand, in acid operation such a drop has been noted before the addition of the deoxidizers. This drop is caused by the change in slag composition and viscosity. As the slag picks up more and more silica from the furnace lining, the free iron oxide content decreases and the viscosity of the slag increases. Both of these factors tend to decrease the rate of diffusion of iron oxide from slag to metal, and as the carbon reaction is proceeding at all times, there is either a decrease in the rate of pick-up of iron oxide or an actual decrease in the iron oxide content of the bath.

Table II

Grades Studied

Constituent	Grade 1	Grade 2
Carbon	0.28-0.33	0.52-0.57
Manganese	0.60-0.80	0.55-0.70
Silicon	0.20-0.30	0.20-0.30
Nickel	1.5 -2.0	1.5 -2.0
Chromium	0.60-0.80	0.60-0.80
Molybdenum	0.40-0.50	0.20-0.25
Vanadium	0.15+	0.15+
Phosphorus (max.)	0.040	0.040
Sulphur (max.)	0.040	0.040

The average iron oxide content of the metal before deoxidation was 0.054 per cent for nine heats of the 0.55 per cent carbon grade and 0.076 per cent for three heats of the 0.30 carbon grade. The single heat of 0.12 per cent carbon steel showed 0.17 per cent iron oxide. As the carbon drops, there is more and more iron oxide to be deoxidized, which with normal deoxidation practice, would result in more and more nonmetallic matter in the final product. However, that the change from the low-carbon steel to the 0.30 per cent carbon steel is more pronounced than the change from 0.30 to the 0.55 per cent carbon steel, a fact which is in accord with theory and which has also been noted in basic open-hearth work.

Slag Is Important

Before discussing deoxidation, it is necessary to remark on the condition of the slag throughout the heat. Not much can be done to control the slag viscosity until about an hour after the ore addition. The increase in the FeO content due to the ore addition makes the slag thin and watery during this interval. It is important that the slag have the proper viscosity when the heat is ready for deoxidation. If the slag contains only silica, iron oxide and manganese oxide, there is a sharp change in viscosity at 56 to 58 per cent silica. On the other hand, if lime is added to such a slag the change in viscosity is not so sharp and the viscosity is regulated more easily. Hence, after the ore has worked through the bath, 200 to 400 pounds of limestone is added to the slag, depending upon its condition at that time.

From then on until the heat is tapped, the viscosity is watched closely, for great care must be taken to see that the slag does not become too heavy or viscous. If this happens the nonmetallic matter in the bath at this time and also the products of deoxidation do not have much chance of entering this type of slag. Moreover, a heat tapped with a heavy viscous slag usually shows a *kick-back* of inclusions in the ladle. That

Table I

Slag Analyses at Various Points in Heat

Typical Slag Analysis at Melt

Type of Heat	FeO Per Cent	MnO Per Cent	SiO_2 Per Cent	CaO Per Cent
0.55 C	19.72	23.60	54.88	0.74
0.30 C	26.44	19.53	51.40	0.46

Total Fe given in terms of FeO.

Composition of Slag and Metal Before Deoxidation

	Slag				Metal		
Grade	FeO	MnO	SiO_2	CaO	C	Mn	Si
0.55 C	15.66	20.79	55.00	4.88	0.49	0.17	0.10
0.30 C	18.88	18.14	55.10	4.12	0.17	0.10	0.08

means that the nonmetallic content of the steel after tapping is higher than the nonmetallic content of the steel in the furnace just before tapping. Thus, before any final additions are made to the heat, if the slag has a tendency to become heavy and viscous, a few shovels of fine ore dust, manganese dust, or scale are scattered over it until it reaches the desired viscosity. Burnt lime may be used at this time, but its action is much slower than the materials mentioned.

If the slag has been worked properly, the only danger which the operator faces is that it may become too heavy through excessive erosion of the furnace lining. However, if the slag should be too thin before deoxidation, which is highly improbable, it may be thickened by either dropping the temperature slightly or adding silica sand. Table I shows the average slag and metal compositions which were found in this work just prior to deoxidation.

Special Alloy Used

The average slag analysis for the 0.55 per cent carbon grade includes the heats deoxidized with ferrosilicon and ferromanganese, and with a manganese-silicon alloy, because the slag analyses were essentially the same for both types of heats.

It will be noted from Table I that the slags on the lower carbon heats contained more FeO and less MnO than the slag on the higher carbon heats. That is a natural result of oxidation by the furnace gases. Similarly the manganese and silicon content of the metal is lower on the lower carbon grade of steel.

If the reaction

$$FeO + C \rightleftarrows CO + Fe$$

is allowed to proceed indefinitely, the carbon content of the steel will fall to a low value. Simultaneously, as the amount of carbon in the steel decreases, the amount of iron oxide increases. Consequently, if steps are not taken to stop this reaction, it would be difficult to meet the imposed chemical specification for the finished product. Likewise, if the FeO content of the steel was not reduced, the metal after solidification would contain large gas holes caused by the evolution of CO gas.

For these reasons, after the carbon in the metal has been lowered to a point near the finishing specifications, either the heat is tied up so that the excess SiO_2 in the slag is reduced, causing a pick-up of silicon in the metal, or deoxidizers are added to the bath to react with the FeO and prevent further reduction of the carbon by forming more stable oxides which are practically insoluble in steel and are reduced only slightly by carbon.

The first mentioned method of finishing a heat, is one which is used without knowledge of what actually happens during this period. From reviews of literature, there are two general theories concerning what actually happens, but few experimental data are available. However, considering the reaction

$$SiO_2 + 2\,Fe \rightleftarrows Si + 2\,FeO,$$

it is a known fact that this reversible reaction actually takes place at steelmaking temperatures. As the temperature increases the per cent of SiO_2 in the slag increases while the per cent of FeO decreases. This means that the silicon content of the metal must increase. Since the reaction

$$2C + SiO_2 \rightleftarrows Si + 2\,CO$$

takes place at exceedingly high temperatures, it is quite probable that this reaction is beginning to take place at steel-making temperatures. Both reactions are possible and there is every reason to believe that both operate simultaneously, as high temperatures favor the reduction of silicon by each reaction.

Table III

Silicate Content

Slag Viscosity millimeters	Change in Per Cent Silicates
6.0	+0.007
5.0	+0.001
4.5	—0.012
4.0	—0.002
3.5	—0.001

The first heats made were deoxidized in the furnace with 50 per cent ferrosilicon and ferromanganese. There was a considerable amount of nonmetallic matter left in the steel when the heat was ready to be tapped. Often the maximum dirtiness of the steel has not been reached until just before tapping time. This allows little time for any cleaning action to take place in the furnace. Consequently, the finished steel contains an appreciable amount of nonmetallic inclusions.

Later, 11 heats were made which were deoxidized in the furnace with an alloy developed at the U. S. bureau of mines in connection with the program on the physical chemistry of steelmaking. This alloy contained approximately 31 per cent manganese, 4.9 per cent silicon, and 2.4 per cent carbon. The amount of alloy added varies with the grade of steel to be made, but in general about 0.15 per cent silicon is added in the form of the alloy. This alloy has a lower melting point than ferromanganese and ferrosilicon separately, and goes into solution much more readily, killing the heat almost instantly. The types of inclusions formed are large and rise out of the bath with surprising rapidity, resulting in an exceedingly clean steel within a few minutes after the deoxidation. From this time on to tap, the smaller particles which have not risen out of the bath have an opportunity to do so. The net result is that the tapping tests are exceedingly clean when the steel is deoxidized with the manganese-silicon alloy. The average silicate content in the tapping tests of the heats deoxidized with the alloy it was less than 0.001 per cent. These data are on steel of the 0.55 per cent carbon grade.

As the investigation proceeded, it was found advisable to add about 0.40 per cent of manganese, as ferromanganese, to the bath about 10 minutes before tapping. This seems to aid materially in cleaning the bath of residual oxides. It should be noted that the use of the alloy followed by manganese results in a steel which is clean not only of deoxidation products, but of any oxides which come from the charge or from the furnace bottom.

The finishing slag has a considerable influence on the cleanliness of the steel in the ladle. If the slag is extremely viscous in the furnace, proper absorption of nonmetallic matter does not take place, with the result that when the heat is tapped the nonmetallic matter floating just under the slag surface is mixed with the remainder of the metal. The net result is a dirtier steel in the ladle than was observed from furnace tests. However, if the slag is of proper consistency, a viscosity of 4.0 to 4.5 millimeters by the inclined-plane method, no such *kick-back* occurs because such a slag will absorb nonmetallic matter from the bath readily. This is shown clearly by grouping the change in nometallic content between the tapping tests and the ladle tests according to the viscosity of the finishing slag. Table III shows the change in nonmetallic content according to this grouping. A positive number indicates an increase in silicate content from tapping test to ladle test, a negative number indicates a decrease.

Viscous Slag Should Be Avoided

It is of the utmost importance, in making high-quality steel, to avoid a viscous slag during the finishing period of the heat. This particularly is true when using the manganese-silicon alloy, because the function of the alloy is to give large inclusions which will rise out of the bath readily. If the slag is too heavy, these inclusions will be thrown back into the steel and will result in large particles in the finished product.

After the steel has been tapped into the ladle, if the temperature permits, the ladle is held 20 minutes before the pour is started. While the steel is being held in the ladle, some of the inclusions which have not been eliminated prior to tapping have a chance to coalesce and rise

(*Concluded on Page* 44)

Determine Clay Content By Short Method

THE American Foundrymen's association method of washing out the clay described in the March, 1931 *Bulletin* on sand testing, involves drying, weighing, agitating in an alkaline solution, washing, drying and reweighing in the order given and according to paragraphs 245, 246, 248, 249, 251, 252, 254, 255.

Uses Tapering Funnel

In the proposed modification an elutriator shown in Fig. 2 for washing out the clay substance, does not materially change the present A. F. A. method. The procedure remains the same up to the syphoning point. *A* is a long type 1500 cubic centimeter separatory funnel with a glass syphoning tube *B*, approximately ¼-inch inside diameter touching the surface of the water ¼-inch from the funnel wall at the widest part.

Valve *E* in tube *C* is for controlling the air inflow and to act as a pressure indicator. This valve should be adjusted so that only an occasional bubble of air is aspirated through tube *C* and drawn through the syphoning tube. With this valve it is possible to control the flow of water through tube *B* so that very little air is present. The bottom of tube *C* should be on a level with the mouth of the syphoning tube *B*. Both tubes are supported in a two-hole rubber stopper.

The tapering funnel is based on the principle that the velocity of a given flow of liquid in a cone, varies inversely with the cross sectional area. Therefore the velocity of the rising water decreases and is least when it reaches the mouth of the syphoning tube *B*. The purpose of this varying velocity is to cause the sand in the narrow part of the funnel to be well stirred and washed while at the same time only that material which fails to settle one inch per minute, is carried to the surface and syphoned off. Some experiments were made with straight tubes, but quantitative separation could not be obtained with them.

Run Comparative Tests

Comparative tests were made with the water level at the opening of the syphoning tube and with the funnel entirely filled with water, thus avoiding any air-water surface effect. No difference in results was obtained.

The apparatus shown in Fig. 1 is for controlling the water pressure. It can be adjusted on a slide, upward or downward for varying the pressure. However, any suitable device for maintaining constant presure may be used. This constant pressure device should be adjusted so that when valve *D* is

Presents Advantages

AS A result of the activities of the sand committee of the Wisconsin Gray Iron Foundry group a report recently submitted recommended the adoption of a modification of the present American Foundrymens association method of clay substance determination in molding sand. It is claimed that the modified method presents two principal advantages: Elimination of the syphoning and refilling operations, and, a more uniform application of wash water. The report was prepared by E. C. Cunningham, research fellow, department of mining and metallurgy, college of engineering, University of Wisconsin, Madison, Wis.

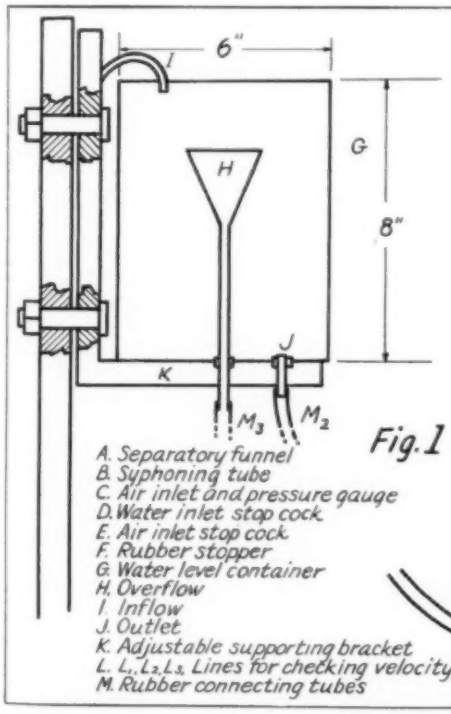


Fig. 1

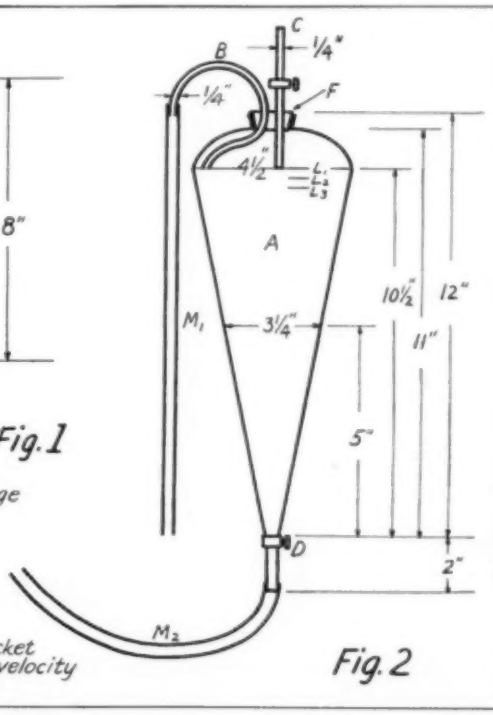


Fig. 2

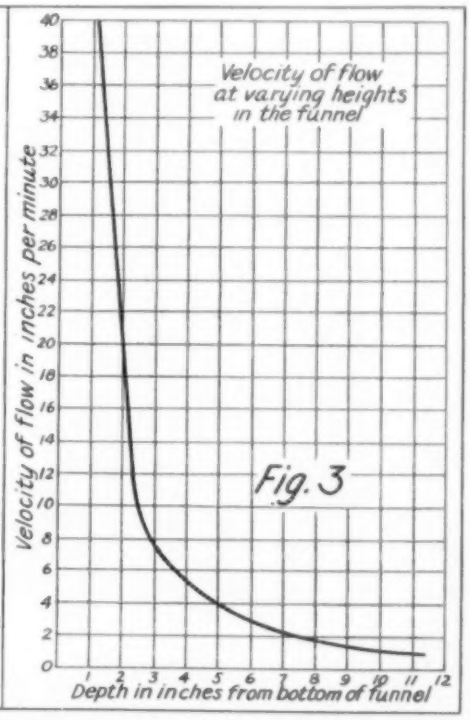


Fig. 3

Fig. 1—Pressure Tank May Be Adjusted Up or Down. Fig. 2—Water Enters At Bottom of Funnel and Passes Up Through Sand. Fig. 3—Velocity of Flow Upward Varies With the Height

wide open, the surface of the water will be rising at the rate of 1-inch per minute when it reaches the widest part of the funnel. Three lines L_1, L_2, and L_3, ½-inch apart at the widest part, permit measurement of this velocity.

After the water pressure has been adjusted for the correct velocity, the sample taken from *step* 3, paragraph 248 previously mentioned in the A. F. A. procedure, is placed in the funnel *A* with the lower valve *D* closed. The valve then is opened to allow the funnel to become about two-thirds filled with water and then closed until nearly all the sand has settled or until the water begins to become clear. This settling prevents fine material from floating away, material that might have been carried to the surface with the first opening of the valve.

The valve then is opened full. The syphon will start of its own accord when the water covers the opening. The sand should be washed until the water above it is clear. Then the valve *D* is closed and the stopper holding tubes *B* and *C* is removed.

Sand which has been freed from material that failed to settle at the rate of 1-inch per minute is washed on to filter paper by taking the funnel out of its clamps, inverting it and opening the valve *D*. Repeated check tests run on sands of widely different clay contents have demonstrated the reliability of this method. Five typical examples are shown in the accompanying table.

Fig. 3, charting the velocity of flow upward at different heights in the funnel, shows that only material which fails to settle 1-inch per minute, should reach the surface. The curve shows that the velocity varies from approximately 40 inches per minute at the bottom of the funnel to 1-inch per minute at the syphonic depth, thus insuring thorough mixing and washing. Some floculent particles of clay may carry over minute quantities of fine sand, but this tendency is lessened by the mixing and washing action in the lower part of the funnel.

Compares Results

Clay Substance

Sample No.	Standard Method	Modified Method
65	{ 28.38 { 25.00	{ 32.68 { 30.60
66	{ 39.43 { 35.12	{ 43.40 { 43.72
67	{ 14.70 { 19.40	{ 23.20 { 22.60
53	{ 10.92 { 10.02	{ 8.90 { 9.78
28	{ 4.23 { 4.03	{ 4.63 { 4.48

Average difference 2.7. Average difference 0.80.

Furnace Manipulation Governs Inclusions

(*Concluded from Page* 42)

up to the slag-metal surface. The silicate content of the steel shows a decrease immediately after tapping. At the first pouring, the level of the steel in the ladle dropped, and the inclusions were overtaken in their ascent. Similarly, during the second and third holding and pouring periods, the same drop and rise in nonmetallic matter was observed. This shows the advantage of holding the ladle before starting to pour.

As the result of this investigation it was found that a considerable amount of nonmetallic matter originating from the charge and from the oxidation of silicon is present in the bath at the time the heat is ready to be ored. This nonmetallic matter is eliminated to a certain extent by the action of the ore, but the addition of spiegel with the ore facilitates the removal of these impurities. In the furnace under investigation, a pick-up of silica was noted during the working period and was attributed to material coming off the bottom. After a high enough temperature is reached, most of this nonmetallic matter is eliminated by the boiling action in the furnace. The use of the manganese-silicon alloy followed by a small manganese addition apparently eliminated inclusions from that source, as well as the normal products of deoxidation.

The iron oxide content of acid open-hearth steel increases gradually as carbon is eliminated. Toward the end of the working period, the iron oxide content of the metal may hold constant or decrease, even though the carbon is dropping, due to changes in slag composition, slag viscosity, and temperature. Deoxidation with manganese-silicon alloys gives an extremely clean steel in the furnace. The alloy works quickly and forms large inclusions which are eliminated readily provided the slag is not too thick. It has been found advisable to use some ferromanganese about 10 minutes before tapping to clean up any residual silica or other oxides which are present at this time. Holding the steel in the ladle as long as possible is of direct benefit in eliminating nonmetallic matter.

Carroll deV. Miller has been appointed manager, eastern branch of the American MonoRail Co., with headquarters at Philadelphia, succeeding the late L. E. Gaston. During the past four years, Mr. Miller as an independent manufacturer's agent at Buffalo, has specialized in engineering and selling equipment, and especially that entering into the solution of mechanical handling problems.

Foundry Is Located on Top Floor

(*Concluded from Page* 25)

runner and branch gates being located in that portion of the mold. The gate of special valve bodies standing next to the T-fittings shows gating partly in the cope and partly in the drag. The runner is in the cope with the branch gates in the drag. The cock bodies shown at the right are gated with both runner and branches in the cope. It also may be observed that the arrangement of the castings on the latter two gates is such that the metal flows *down* into the lower portions of the castings, and prevents any tendency toward bleeding from the castings to the gates. The gate of patterns for valves, shown at the top of the group, is gated from the cope; both branch gates and runner being located therein.

After each molder makes up a small lot of molds ranging from 30 to 40, the castings are poured, allowed to solidify, and then shaken out. Castings are removed from the sand and placed in wheelbarrows. The sand is reconditioned as mentioned earlier in the article by a separate crew. Castings from the molding floors are transported to the cleaning room which is along one side of the building approximately at its center. Gates are removed from the castings mainly with a sprue cutter. The castings next are ground on one of two double stand, or single stand abrasive wheels to remove the remaining excess metal at the points where the gates were attached to the castings, small fins, rough spots, etc., that can be handled in that manner. After the castings have been ground, they are cleaned in one of two sandblast mills supplied by the W. W. Sly Mfg. Co., Cleveland, or in a water tumbling mill depending upon the type of finish desired. Cleaned castings are placed in tote boxes and sent to the floors below where further operations of machining, etc., are conducted.

Publishes Symposium

One of the features of the meeting of the American Society for Testing Materials held in June in Chicago was the symposium on the economic significance of specifications for materials which was held in co-operation with the Western Society of Engineers. Six papers were presented on the application and uses of specifications by manufacturers and consumers of steel concrete, and other engineering materials. Those papers now are available in the form of a 46-page bulletin recently published by the American Society for Testing Materials, 1315 Spruce street, Philadelphia.

The FOUNDRY Family Photograph Album

Upper Left

A. S. BEECH
Universal System of Machine Molding & Machinery Co., Ltd., London

Upper Right

G. S. SCHALLER
University of Washington, Seattle

Lower Left

W. M. BURRILL
Fay & Scott Mfg. Co.
Dexter, Me.

Lower Right

J. C. ROGERS
Crown Stove Co., Chicago

BILL

By Pat Dwyer

Comments on Number of Men in Shop

THEY tell me" said Bill the other night while absorbing a little more than his share of the heat from the first grate fire of the current fall season, "they tell me that you made a valiant, but unfortunately losing effort to corner the ice market this morning."

"Bill," I said, "you are not exactly an old man, that is old in the sense of physical and mental decay. You have not yet reached the stage where you are compelled to creep around on two dragging and faltering feet plus a cane. At times you show gleams of almost human intelligence, gratifying evidence that the brain still is functioning. I would not go so far as to say that the old block is hitting on all of the two cylinders constituting the original installation, but at the same time scattered fragments of evidence show that the spark of life still is present. Feeble of course, but still in existence. With proper care and attention I should not be surprised—"

"Surprised at what? What's the idea of dragging a person's age into a discussion of ice? In fact if I may make so bold, beggin' yer 'oner's pardon and—er—one thing and another, why start a discussion of any kind?"

"My idea exactly, dear lad. Far be it from me to start any argument or discussion with you. I simply wanted to show you—as gently as possible—what a silly figure you cut in (a) believing all you hear, and (b) in trying to elaborate the same hearsay evidence into a ponderous, unwieldy and at the same time drab kind of humorous observation.

"I am neither Sherlock Holmes nor his shadow, but I need only one guess on where you received what no doubt is a highly garbled account of a trifling incident. If you were a giddy young sprig, a callow youth who believes that every goose is a swan, I should make due allowance for that fact and say no more about it.

"Here you are, a lad who has knocked around the country, and up against many of the inhabitants thereof. A man, if I may say so, inclined to boast that he can see as far into a grindstone as any lad of his eyes and inches in the bailiwick—whatever that is. A man who has reached the stage known among ordinary people as the age of discretion, and still, as my old aunt used to say, 'The saints be bechune uz an' all harm'—still you believe any idle rumor that floats into your long hairy ears.

"The incident no doubt, to which you refer happened this morning. So far as that part of your information is concerned, you are absolutely correct."

The Early Bird Finds the Ice Box Empty as Mother Hubbard's Cupboard

"Very kind of you, I'm sure," Bill conceded handsomely, "very kind of you to make such a generous admission. Really, it is more than I expected. Now if you can see your way clear—on sober second thought, of course—to admit that I had the story straight all the way through, why, we can consider the thing settled unanimously, call it a day and knock off."

"I like that," I said. "Sober second thought! If you had given that scurrilous version even half a second thought, you would have perceived that it was a gross exaggeration. You would have dismissed it from what in all charity I may refer to as your mind, instead of coming in here rubbing your hands and gloating over what you are pleased to consider an embarrassing experience.

"Finally, and as a clinching argument, a man married as long as you have been should know enough to sprinkle a few grains of salt over any statement a wife makes about her husband—particularly if that statement is designed to show him up in a ludicrous light. Dash it all, man, where is the old *esprit de corps*, the stick together stuff, the one for all and all for one spirit, the shoulder to shoulder, boys of the old brigade formation so necessary to the maintenance of our authority and dignity?"

"Authority and dignity, sez he! Boy, you certainly are one little gilt edged optimist. I've never seen a woman—even a half pint size, 4 feet 7 in her high heeled shoes and weighing 79 pounds—who could not knock the dignity and authority out of a giant with a crook of her finger or a lift of an eyebrow. Have him on his knees, eating out of her hand like a baa-baa, little woolly pet lamb. If I were to call a certain lady in at the present moment and ask her to repeat what she told me about your activities among the ice cakes this morning, I'll bet you any amount in reason—say up to two bits—that you would not contradict her. There's a chance to air your dignity and authority and incidentally pick up a little easy money."

"Bill," I said, "a man with your long, keen financial nose simply is wasting his time in the foundry. I don't pretend to follow your line of reasoning, but if you think I have any intention of paying an additional two bits for a lesson I learned many years ago, then all I have to say is that you had better have a garage man examine the block, on top of your neck!

"In the meantime I'll give you a brief, plain and unvarnished account of what happened this morning. If you can extract any amusement out of the incident, you're a better man than I am, Bang O'Din.

"With the arrival of cold weather, the hunk of ice in the kitchen ice box lingers a little longer than it did in the summer. When I opened the door this morning I discovered quite a sizable remnant and therefore decided to set the ice card for a 25-pound lump instead of the usual 50. Times without number when setting out this card I have made a resolution to drive a nail on which to hang it. Unfortunately I have no time in the morning to go prowling around looking for a hammer and nail. When I return at night something

always turns up to divert my attention. Owing to local conditions, the card would not be visible if placed inside a window and as a result I have to set it outside on the top step leading to the veranda.

"After I had shaved and dressed and more competent hands than mine had laid hold on the breakfast arrangements, I looked through the front door window and to my amazement discovered that the card had vanished. No card, no ice, I reflected and probably a vote of censure coming to me for culpable negligence. I found the wretched thing behind a bush where it had been deposited by a vagrant puff of wind.

"Clearly, with the passing of the ice man more imminent every moment, it behooved me to have the card on display. I could not stay there holding the card and if I set it down, the wind probably would blow it away again. I hunted up a hammer and a long sharp nail and fixed the card firmly in place.

"A little later the ice man entered the kitchen with a 50-pound block. He had to remove the existing piece and chop it into small fragments to make room for the new block. The lady who told you the story arrived on the scene just as the door was slammed. She demanded indignantly why I had ordered a 50-pound block. I claimed that I had set the card for 25. Then she wanted to know why I had allowed the ice man to palm off a 50-pound block on me. I explained that the man probably had made a mistake in reading the card, but that I did not have the heart to ask him to make two trips for the sake of a 25-pound differential.

"You would imagine that would close the incident. Did it? It did not! Some people are so suspicious! She marched out to the front step and presently came back to ask me why I had not ordered all the ice on the truck. To my claim that I had set the card for a 25-pound block she calmly laid the card on the table with the nail still in place over—not the 25 or the 50 or the 75—but over the 100!"

"Well," said Bill, "that brings us back to where we started. You wanted 25 pounds of ice and you ordered 100. If that does not constitute a cold and brazen effort to horn into the field of big business, then I should like to know what it is. I was right the first time. However, talking about big business reminds me that small business also has its troubles.

"For example I had an inquiry recently from a man who was wondering if he was carrying too large a staff. He said that he was running a small jobbing gray iron foundry in which the daily heat was about 7000 pounds. He employs eight molders, one coremaker, one apprentice, one carpenter, one cupola man, one helper, one sand mixer, one chipper, one grinder, one shipping clerk, one truck driver, one night man to cut sand and remove the castings. He wanted to know how this distribution of men measures up with ordinary foundry practice.

"In a 28-inch inside diameter cupola he charges the iron in 1000-pound lots with 65 pounds of coke between the charges. Each charge is made up of 200 pounds of pig iron and 800 pounds of miscellaneous scrap. The pig iron shows the following analysis: Silicon 3.25 per cent, sulphur 0.04 per cent, phosphorus 0.60 per cent, manganese 0.85 per cent. The fan delivers air at the rate of 2500 cubic feet per minute. He inquired how the foregoing compares with melting practice elsewhere.

"With the exception of one or two points the conditions existing in this shop represent those that prevail in the majority of small and medium size foundries. I assume that by a daily heat of 7000 pounds he means the amount that is charged in the cupola. Allowing 20 per cent for furnace loss, defective castings,

Perhaps the Iceman Is a Mind Reader

gates and scrap the net weight of saleable castings is 5600 pounds, or between 600 and 700 pounds for each molder. Men are required to fill all the positions he mentioned, but several of these jobs do not require a man's full time. For example: Two men are not required on the cupola to handle a daily heat of 7000 pounds. One good man could do all the work himself. A mediocre man could do it if the foreman or some other employe attended to the tapping. Some person must attend to the shipping, but I think his duties may be merged with those of the truck driver. The sand mixer probably is a general utility man and I presume the night man also acts as night watchman.

"He might experience some trouble in machining thin castings poured from the iron mixture, but it should prove satisfactory for the general run of small and medium weight castings. However, I cannot understand how he can melt 1000-pound charges with only 65 pounds of coke between them. An extraordinarily high bed might help to tide over the first three or four charges, but I should expect to find the iron in the later part of the heat too cold to be of any use. Also I cannot conceive of a cupola dropping clean under such extraordinary conditions. Another thing I cannot understand is why he should blow 2500 cubic feet of air per minute into a 28-inch cupola. That amount of air is sufficient to melt 5 tons of iron per hour and a 28-inch coupla has only a rated melting capacity of approximately 3 tons of iron per hour.

The Fortune Teller Warns Him To Beware of Cards and High Numbers

DAN M. AVEY
Editor

The Shakeout

FRANK G. STEINEBACH
Managing Editor

PAT DWYER
Engineering Editor

EDWIN BREMER
Metallurgical Editor

CHARLES VICKERS
Nonferrous Editor

NORMAN F. HINDLE
Assistant Editor

¶ It's Only Two Years Now

IT seems rather unnecesary in this, the heyday of the automobile, to point to the fact that operating machinery does wear out. After a few years of average driving, replacement of certain parts becomes necessary, breakdowns appear more frequently and repairs and adjustments continually are necessary. This finally reaches the point where it would be far more economical to junk the machine and purchase a new automobile. The process of wearing out, with which we are all familiar, is called depreciation.

NEVERTHELESS, the purchaser of a new automobile seldom expects or does drive the car until it is worn out. He realizes that improvements and developments constantly are being made by the builders of cars, and that in perhaps less than a year, a new and improved model will be on the market. It may be greater speed, smoother running, better riding qualities, easier operation, or a variety of merits which provide the necessary incentive for the purchase of a new car. Here *obsolescence* rather than *depreciation* is the cause of discarding the old model.

SO it goes in industry. Manufacturers of machinery which is utilized in industrial operations, constantly are spending time and money to develop new equipment and processes and to make refinements in those already in use, that in the long run production costs may be cut. Twenty, or perhaps even fifteen years ago, when new developments were not appearing with such great rapidity, larger companies, that understood the importance and necessity for accurate cost information, considered seven years as the period for charging off due to obsolescence. In other words, if a machine could show a saving sufficient to pay for itself in seven years, the management usually would be favorable to the purchase.

TODAY, radical changes are taking place in management's attitude toward obsolescence. Before approving purchases of new equipment, several of the larger industrial concerns demand proof that the machine will save the initial cost in two years. With that information, the appropriation usually is made, the machine is placed in operation, costs of manufacture are reduced and competition in the industry is increased.

DURING the past year, wide awake companies have been studying plant equipment carefully to determine where changes can be made, new machines installed, and other improvements made, all with the idea of cutting production costs. The foundry or other industrial concern that has not taken advantage of this period of subnormal business activity to look over equipment and process to plan for replacement of that which is obsolete will find the competition mighty keen when the increase in demand comes. Some will send hurry up calls for equipment and then limp along until their turn comes for delivery. Others will fall by the wayside.

¶ Acorns Rattle on the Roof

SPORADICALLY, prophets of woe predict extinction of the foundry industry. These dire forecasts have appeared from time to time during the past ten years, applied indiscriminately to the many classifications of castings manufacture in some instances and again directed at some branch which seems to laymen to be laggard in the procession. Perhaps the wish is more than stepfather to the prophecy in many cases, particularly when coupled with claims and rosy prophecies for materials or processes that are placed in the competitive class—by the prognosticators.

THE widespread and blind acceptance of some of these prophecies and attendant propaganda by the disinterested public has puzzled many well informed foundrymen. It has occasioned some apprehension, from time to time. This in itself has been a service to the foundry industry in unifying thought along the line of cooperative action to refute the misinformation that has formed the background of some of this agitation. Looseness in statement and exaggeration never aids, but rather recoils upon the user.

HOWEVER, misrepresentation should not go unchallenged. Nor should the foundry industry remain silent in the face of reiterated, although recently more veiled threats of supersedence by materials and processes that claim competitive or superior standing. No house is demolished by the rattle of acorns on the roof. Economic trends in manufacture cannot be induced by claims and charges, nor can ground be maintained in the manufacture and sale of any commodity by failure to use modern methods in engineering, manufacture and sale.

Comings and Goings of Foundrymen

Men of the Industry, Whose Activities Are Making Foundry History

J. J. BAUM, formerly head of the development engineering department, Steel Founders' Society of America, New York, has been made metallurgist, Bosshardt Steel Corp., Canton, O. Mr. Baum attended Carnegie Institute of Technology, Pittsburgh, where he specialized in metallurgical engineering. During the 4½ years that he attended that institution, he devoted considerable time to metallurgical research at local steel mills and foundries including the American Steel Foundries, Verona, Pa. Later he became chemist and metallurgist, National Alloy Steel Co., Blawnox, Pa., manufacturers of heat and corrosion resisting alloy castings. He resigned that position to become sales and design engineer, General Alloys Co., Boston, and later was associated with the Ohio Steel Foundry Co., Springfield, O.

W. L. Hayner has been appointed general manager, Algoma Foundry & Machine Co., Algoma, Wis., succeeding B. L. Larkin.

Ralph D. Nye, formerly chief engineer for the Wheeling Mold & Foundry Co., Wheeling, W. Va., has joined the Lewis Foundry & Machine Co., Pittsburgh, engaging in sales and engineering work.

H. Y. Jemison, formerly pattern shop superintendent, Bethlehem Shipbuilding Corp., Ltd., Fore River plant, Quincy, Mass., has been appointed foundry and patternshop superintendent of that plant.

C. K. Strausbaugh has been appointed vice president in charge of sales, Mead-Penn division, New Castle, Pa., of the newly formed Pennsylvania Engineering Corp., New Castle, Pa.

Daniel Seltzer, president, Ohio Cultivator Co., Bellevue, O., was elected president of the National Association of Farm Equipment Manufacturers, at the close of the thirty-eighth annual convention held at Chicago, Oct. 21-23.

Charles Deere Wiman, president, Deere & Co., Moline, Ill., was elected chairman of the executive committee.

Oliver Smalley, director of research, Gray Iron institute, Cleveland, is scheduled to speak before the Boston chapter of the A. S. S. T. at Massachusetts Institute of Technology, Cambridge, Mass., Friday, March 4, 1932. The subject of his talk will be "Iron Castings and Their Heat Treatment."

F. W. Rowe was the recipient of the Constantine gold medal at the opening session of the Manchester Association of Engineers, Manchester, England, Oct. 9, in recognition of data contributed on "The Selection and Treatment of Gear Materials." **J. S. Glen Primrose** was awarded the Butterworth gold medal for the best series of contributions to the discussion of the season's papers. Both are members of the Lancashire branch and have been active for many years in the affairs of the Institute of British Foundrymen.

J. J. Baum

Discuss Refractories

The Pittsburgh Foundrymen's association held the first regular meeting of the 1931-1932 association year on Oct. 19 at the Carnegie Institute of Technology. About 50 members and guests were present. The principal speaker was M. C. Booze, vice president of the Charles Taylor Sons Co., Cincinnati, producer of super-refractories. Mr. Booze discussed the development and practical application of sillimanite and mullite refractories.

Ohio Engineers Meet

A symposium on ferroalloys, ores, fluxes and refractories was a feature of the fall meeting of the Ohio section of the American Institute of Mining and Metallurgical Engineers, held at Battelle Memorial institute, Columbus, O., Oct. 30. Jerome Strauss, Vanadium Corp. of America, Bridgeville, Pa., spoke on ferroalloys and the ores of silicon, chromium and vanadium. Molybdenum and tungsten were discussed by E. A. Lucas, Molybdenum Corp. of America, Pittsburgh; and refractories and fluxes, were covered by Dr. G. A. Bole, engineering experiment station, Ohio State university, Columbus, O.

Moving pictures showing the manufacture and uses of steel plant refractories were presented by O. L. Day, Harbison-Walker Refractories Co., Pittsburgh. The meeting was concluded with after dinner speeches by Dr. H. Foster Bain, formerly of the American Institute of Mining and Metallurgical Engineers, New York, and Dr. W. O. Hotchkiss, Michigan College of Mining and Technology, Houghton, Mich.

Pacific Coast Group Elect Officers

The Pacific Coast Founders association, at its annual meeting held Oct. 15, elected the following officers: Charles J. P. Hoehn, Enterprise Foundry Co., San Francisco, president; F. G. Johnson, American Foundry Co. Inc., Alameda, Calif., vice president; Charles A. Kingwell, Kingwell Bros. Ltd., San Francisco, treasurer; and Maurice S. Greenberg, M. Greenberg's Sons, San Francisco, secretary. In addition to the officers, who also are members of the board, the following directors were elected; Fred C. Kobely, Bethlehem Shipbuilding Corp. Ltd., San Francisco, and Elmer S. Anderson, Anderson-Barngrover Mfg. Co., San Jose, Calif. S. M. Truitt continues as manager of the association.

Appointed Manager

C. Kirk Hillman has been appointed district manager, Chicago Pneumatic Tool Co., New York, in the Seattle, Wash., district. The office and service station of the company also have been moved from 1743 First avenue south to 3201 First avenue south, Seattle. New quarters make it possible to carry a complete stock of repair parts as well as representative items of the company's various products.

Unit heaters will be one of the features in the warm air heating section of the Second International Heating and Ventilating Exposition to be held in Cleveland, Jan. 25-29, 1932, under the auspices of the American Society of Heating & Ventilating Engineers.

OBITUARY

Carl A. Johnson, president, Gisholt Machine Co., Madison, Wis., died suddenly Oct. 30, shortly after participating in a conference of Wisconsin industrialists with the governor on unemployment relief. Mr. Johnson was born at Madison, April 21, 1870 and was graduated from the University of Wisconsin in 1891 with a degree in mechanical engineering. He immediately entered the employ of the Gisholt company, later becoming vice president and general manager, and in 1908 he was made president. Mr. Johnson served as president of the National Machine Tool Builders association in 1930.

Nathaniel Curry, a member of the Canadian senate since 1912, and the first president of the Canadian Car & Foundry Co. and later chairman of the board, died Oct. 23 at his summer home at Tidnish, N. S. He was 80 years old.

Elmer W. Deved, assistant superintendent of production for the Yale & Towne Mfg. Co., New York, died Oct. 27 of a heart attack at the company hospital in Stamford, Conn., He had been associated with the company for nearly 34 years.

James E. Evans, S. Obermayer Co., Chicago, died recently after a brief illness. Mr. Evans was connected with the Obermayer Company for almost 40 years and was especially well known in the Chicago territory where he represented the company for a considerable time.

George A. Hart, 63, manager, Melrose Park works, National Malleable & Steel Castings Co., died Oct. 19. Mr. Hart was born in New York, and was graduated from Lehigh university, Bethlehem, Pa. He was first employed by the Bethlehem Steel Co., and when the National Malleable & Steel Castings Co. acquired the Latrobe Steel & Coupler Co., Melrose Park, Ill., was made manager of the National company.

Louis Johnson, age 59, for 25 years owner of the former Acme Journal Bearing Co., Van Buren and Canal streets, Chicago, died Oct. 27, at his home in that city. Mr. Johnson had been in the foundry business most of his life after going to Chicago from Norway as a young man. He started as a brass molder and was sole owner of the Acme Journal Bearing Co. for 25 years. Mr. Johnson sold his interest in that company seven years ago.

Ernest Dubert who was employed continuously for 37 years as patternmaker foreman for Huntley Mfg. Co., Silver Creek, and later Brocton, N. Y., died in Buffalo Oct. 21. Mr. Dubert served his apprenticeship at the Brooks Locomotive Works, Dunkirk, N. Y., and later was employed by the Holley Steam Pump Works and other foundry and manufacturing establishments of Buffalo. When the plant of the Huntley Co. was removed from his home town, Silver Creek to Brocton Mr. Dubert continued in his position, driving 20 miles to be at this work every day.

Advises Safety Study in Slack Times

An outstanding subject to be brought before the fifteenth annual New York State Industrial Safety congress, in Buffalo, Nov. 16, 17 and 18, is that of "Safety Preparedness" by which is implied the utilization of the present period of slackened business for the improvement of conditions affecting safety and the introduction of safety measures.

Due to the fact that many industrial companies are being operated with reduced working forces and reduced working hours, it is believed that safety measures may be introduced more easily now than during periods of intense activity. Organizations may make surveys of their plants, removing hazards, installing safety devices, and training the personnel in methods of safety.

Malleable Output Up

Production of malleable iron castings in the Philadelphia district during September reached the highest point reported during the past year, according to a report on foundry operations by the industrial research department, University of Pennsylvania, Philadelphia. On the other hand, tonnage of gray iron and steel castings produced decreased to the lowest point of the year. The tonnage of gray iron castings made in September was 2.6 per cent less than during the previous month and 45.6 per cent less than in September, 1930. The decrease in activity from August was caused by a lessened output of castings for jobbing work. The volume of castings used for further manufacture within the plants increased 13.0 per cent during September.

Joins Institute

Election of the Champion Hardware Co., Geneva, O., and Motor Castings Co., West Allis, Wis., to membership in the Gray Iron institute, has been announced by Arthur J. Tuscany, manager. Thorpe Miller represents the Geneva firm while E. L. Roth, secretary and general manager, is the Motor Castings company's representative.

The Buckeye Portable Tool Co., Dayton, O., has moved its factory and offices from 135 Wayne avenue to 29 West Apple street. W. W. Price is president.

Aids in Raising Fund To Stabilize Bank

Thomas W. Pangborn, president, Pangborn Corp., Hagerstown, Md., recently served as chairman of the committee of three directors of the Hagerstown Bank & Trust Co., who were selected to raise $1,000,000 to strengthen the institution, one of the oldest and largest banks in the state outside of Baltimore. The undertaking was accomplished in three days and followed the closing of two banks in Hagerstown, and two others in the county during the preceding week. The plan followed by the committee has attracted the attention of other bankers, particularly in the east. The tenth day after the plan was placed in effect, the bank enjoyed one of the largest days in its history in the excess of deposits over withdrawals. The bank was established in 1806.

Ohio Group To Meet

Two prominent speakers, E. I. Evans, actuary for the Ohio Industrial commission at Columbus, O., and Fred G. Bennett, Buckeye Steel Casting Co., Columbus, chairman of the Ohio foundry code committee, will be speakers at the annual meeting of the Ohio Foundries association on Nov. 19. The meeting will be held at the Deshler-Wallick hotel, Columbus, according to Robert Hoierman, Cleveland, secretary of the organization.

Mr. Evans will speak on "Employer's Control of Workmen's Compensation Rates." Mr. Bennett will speak on various phases of the state foundry code. These talks will be in line with the statewide safety campaign being conducted by the association in an effort to reduce the number and severity of accidents and secure a lower state insurance rate next July.

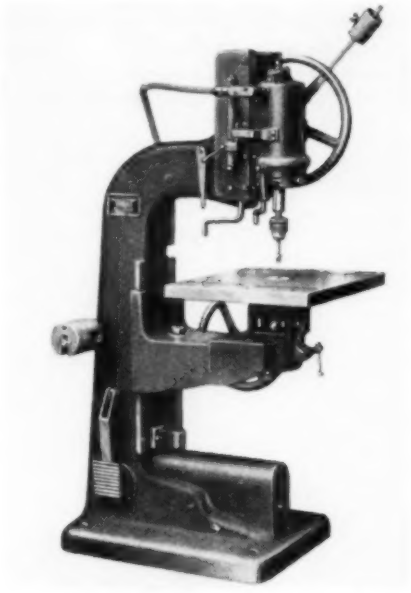
To Test Sands

The Dietert-Detroit Laboratory recently has been opened by Harry W. Dietert Co., 676 West Grand boulevard, Detroit, to conduct a control and research investigation of foundry molding materials. Particular attention will be given to sand control testing with its relation to casting defects. Tests will be conducted in accordance with A.F.A. specifications.

Homestead Valve Mfg. Co., Coraopolis, Pa., has secured the contract for the main spray control valve and remote control unit for equipment for descaling hot steel by high pressure water sprays. Equipment will be installed at the Otis Steel Co., and the West Leechburg Steel Co., West Leechburg, Pa.

Router Is Designed for Pattern Work

Oliver Machinery Co., Grand Rapids, Mich. has introduced a new pattern router and borer especially adapted for rapid and accurate boring, milling or routing, light shaping, and recessing of small core boxes and patterns, It will bore holes up to 2 inches in diameter, any depth up to 6 inches, in the center of 36-inch stock with one



The Table Swivels in a Complete Circle

stroke. The table is adjusted easily 12 inches in a vertical direction, swivels in a complete circle and can be tilted 35 degrees in all directions. The spindle has a maximum stroke of 6½ inches.

The table measures 20 x 24 inches, is cast of special iron, heavily ribbed and accurately machined on top and four sides. Holes are bored in the table top for wood screws to fasten wooden tables or forms for special work. The table swings completely around, also tilts in any direction at any angle up to 35 degrees. A round machined hole with a shoulder recess is located in the center of the table. A removable aluminum center plug with a pin protruding ⅜-inch above the surface fits into this hole and acts as a guide for hand routing against a template. When the plug is removed, the hole serves as a clearance for the bit and allows the chips to fall to the floor.

This machine is of the motor head type operating at 3600 revolutions per minute. Ball bearings are totally enclosed. A blower fan with blower pipe leading to the work helps cool the motor and tools, also blows the chips away from the work. The spindle, to which bits and cutters are attached, has a speed of 3600 revolutions per minute. The vertical movement of 2½ inches to 4 inches is controlled by the foot lever. A vertical steel bar with rachet stop block and adjusting screws and a lock nut, located on the left side of the head act as an automatic stop for stroke regulation of the movable head unit.

Builds Air Heaters

A line of horizontal electric air heaters for industrial applications has been developed by the General Electric Co. Schenectady, N. Y. Five ratings are listed: 1000 watts at 115 volts; and 1000, 2000 3000 and 4500 watts at 230 volts. The heaters consist of a number of strip heaters mounted in black japanned, perforated, pressed steel cases. Each is equipped with three feet of armored cable and a three-heat snap switch mounted on a standard conduit box. They are designed for wall or floor mounting.

Features claimed for the new line include the free circulation of air providing maximum heat, the ease with which the units may be installed, the lightness and strength of construction, the fact that heat always is available at the turn of a switch and the absence of soot, dirt or obnoxious odors.

Merges With Caldwell

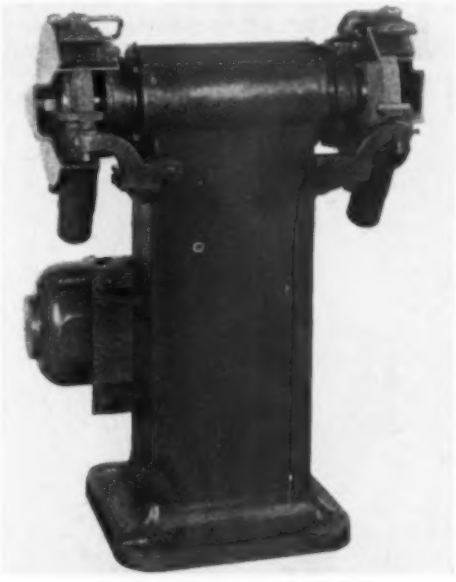
Merger of the George W. Moore Co., Chicago with H. W. Caldwell & Son Co., a subsidiary of Link-Belt Co., has been completed. The combined units are to be known as the Caldwell-Moore division, Link-Belt Co. Max H. Hurd, formerly president, George W. Moore Co., becomes a vice president of Link-Belt Co., in charge of the Caldwell-Moore operations. His headquarters will be at 2410 W. Eighteenth street, Chicago.

Faked Foundry Facts

A Skimmer

Multiple V-Belts Drive Floor Grinder

The general purpose floor grinder illustrated herewith recently was developed by the Hammond Machinery Builders, Inc., Kalamazoo, Mich. Power is transmitted from the driving motor to the spindle by V-belting. The motor is located on the rear of the pedestal. It is totally enclosed and ventilated through an air



This Grinder Affords Ample Clearance Between the Wheels

cleaner. It is pointed out that the motor thus located permits a comparatively small diameter spindle housing which gives ample clearance between the wheels. The grinders are supplied in 1, 2, 3, and 5-horsepower capacities to accommodate 10, 12, 14, or 16-inch diameter wheels.

The entire spindle assembly can be removed from the pedestal without disturbing any operating part which is said to be advantageous when renewing belts. The spindle runs in ball bearings of liberal dimensions. Lubrication is through an oil bath and a double labyrinth seal keeps out grit and dirt. The wheel guards are adjustable two ways so that the gaps between the wheels and the rests can be maintained at the correct distance as the wheels wear away. The eye shields are adjustable.

Is Made Manager

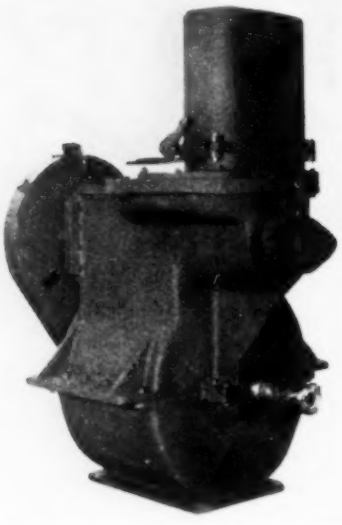
Ralph Leavenworth has been appointed general advertising manager, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. He will have charge of all publicity and advertising activities of the company, including advertising division of the merchandising department, now centered at Mansfield, O. Mr. Leavenworth has been identified with both Austin Co. and Standard Parts Co., Cleveland.

Dust Is Collected and Mixed with Water

Edgar E. Brosius Inc., Pittsburgh, has developed a flue dust conditioner which, can be adapted to a wide range of dust problems. One of these units is shown in the accompanying illustration.

With this device, dust is conditioned directly at the dust catcher. The dust is conditioned by being passed through a rotating cage wherein it is agitated and mixed with water. Any degree of moistening can be obtained by regulating the water supply.

It is claimed that practically no free dust escapes which eliminates



Dust Is Passed Through a Rotating Cage Where it Mixes With Water

dust clouds and subsequent cleaning up, as well as reducing wear on equipment ordinarily resulting from abrasive particles when untreated dust is emptied.

Meter Gives Relation of Air and Fuel

Bailey Meter Co., 1050 Ivanhoe road, Cleveland, has developed a ratio meter for use as a combustion guide in the control of gas or oil-fired heaters, kilns and industrial furnaces. One of these meters is shown in the accompanying illustration.

Two recording pens are employed: One for rate of oil flow, this being mechanically actuated by differential pressure produced by an orifice in the fuel line; the other recording air flow to the burner in a similar manner. During installation, a combustion test is run to determine proper ratio of air flow to oil flow, the air flow mechanism then being adjusted so that this ratio is maintained so long as the two records coincide—one upon the other.

In operation, should the air flow pen rise above the fuel flow pen, too much air is being admitted, with consequent stack losses. Conversely, should the air flow pen fall below the fuel flow pen, too little air is being admitted, with consequent unburned fuel loss. To attain maximum efficiency, the furnace operator merely keeps the two pens together by proper manipulation of the air supply.

This instrument also serves as an effective fuel meter, indicating and recording in any convenient terms. Total fuel flow can be measured by a four-dial integrator which is optional equipment.

Auxiliary temperature and pressure recorders readily can be attached to record these factors in distinctive colors on the chart with the flow records. The 12-inch diameter charts are uniformly graduated and are marked with direct reading scales, making comparison of related factors a simple operation.

Made Sales Agents

Wm. H. Muller & Co. Inc., 122 East Forty-second street, New York, have been appointed by the Dutch furnaces as agents for the sale of pig iron in the eastern and southern districts of the United States, succeeding Pilling & Co., Philadelphia, who recently retired from the pig iron business. The Koninklijke Nederlandsche Hoogovens on Staalfabrieken's plant (Dutch furnaces) is located at Ymuiden, Holland, about 15 miles from Amsterdam. It is about 1½ miles from the North sea with direct communication by deep water canal. There is also a special harbor for water transportation by barge through all parts of Holland which connects with central and western Europe.

Chatard and Norris, 218 Water street, Baltimore, have been appointed representatives of the Homestead Valve Mfg. Co., Coraopolis, Pa., for the Eastern part of Maryland and the District of Columbia.

Two Recording Pens Are Employed on the Meter

Flexible Shaft Tool Is Adaptable

Flexible shaft machines put on the market by McNeil Brothers Co., Cincinnati, are designed to cut costs by increasing production and labor efficiency. The machine, shown in the accompanying illustration, is an all-purpose tool. Features of construction make it adaptable to all flexible shaft jobs including grinding, wire brushing, drilling, buffing, polishing, sanding, form filing, and rasping.

Three speed changes are provided on the machine as illustrated. A high speed attachment, not shown in the illustration, makes possible six speeds

Flexible Shaft Machine Is Applicable to a Wide Variety of Work

ranging from 865 to 10,500 revolutions per minute.

Two models of the machine are provided. The smaller carries a ½-horsepower motor made by the General Electric Co., Schenectady, N. Y. and the larger a 1 horsepower motor of the same make. The smaller machine has capacity up to a 6 x ¾-inch grinding wheel, 6 x 1 inch wire brush, 9 inch sanding disk, and ⅜-inch drill. The 1 horsepower machine has capacity up to a 8 x 1 inch grinding wheel, 7 x 1 inch wire brush, 9-inch sanding disk, and ⅝-inch drill.

Both machines are roller bearing equipped with positive contact shaft slide coupling. The flexible shaft supplied is 7 feet long. The motor rests on a ball bearing race which allows it to swivel through 360 degrees. Thus the moving parts are away from the operator at all times and the motor switch is always within reach at the operating side.

Approximately 10,000 tons of cast iron segments will be required for development work at Washington in connection with the Pennsylvania railroad's electrification program.

What Others Are Thinking

Abstracts Selected from European Foundry Literature

Investigate Cupola Process

A metallurgical Contribution to the Knowledge of the Cupola Process (Metallurgische Beitraege zur Kenntnis der Kupolofenvorgaenge), by Bernhard Osann, Jr., *Die Giesserei*, Dusseldorf, Germany, Oct. 16, 1931.

This is the first section of an article on an investigation of the cupola process which was carried out on cupolas in commercial operation and with cupolets. Further work on melting was done in an electrically heated crucible furnace. The commercial cupolas were 47, 45 and 41 inches internal diameter. By increasing the weight of the coke splits beyond a definite point the speed of melting was decreased, and the amount of carbon dioxide in the cupola gas decreased and carbon monoxide increased. By incasing a thermoelement in a pig which was allowed to descend with the charge, it was found that melting began more rapidly with the pig exposed to high temperature than with ones slightly lower. For example at 2012 degrees Fahr. melting began in 17 minutes, at 1922 degrees Fahr. it was 25 minutes, and at 1868 degrees melting began in 29 minutes. With increasing coke between charges it was observed that the carbon in the iron increased, and further increase in the coke caused a decrease in the carbon content.

Compare Test Bars

Mechanical Properties of Malleable Iron on Various Size Test Bars; by A. L. Norbury; *Foundry Trade Journal*, London, Sept. 17, 1931.

This paper present at the Pan-European Foundry Congress, Milan, Italy, contains an account of transverse, tensile, bend and elongation tests on round and oblong test bars of various sizes in black heart and white heart malleable iron, after one, two and three anneals and with increased manganese content. Micrographs of the ¼-inch and the ½-inch round bars from edge to center, are shown for each of the types. Variations in mechanical properties with size of test bars are related to the microstructure. As the size of the black heart test bar increases, the transverse strength increases appreciably, while the bend decreases. As the size of the white heart test bar increases, the strength increases and then decreases while the ductility progressively decreases. With increase in number of anneals the ductility of white heart progressively increases, while the strength varies in a complicated manner. Increasing the manganese content of white heart from 0.08 to 0.56 per cent shows a remarkable effect in increasing the strength and ductility of all except the smallest bars. In nearly all cases the round bars show greater strength and ductility than oblong bars of like cross section. The problem of standard test bars for malleable iron is discussed. Round bars 0.253, 0.564 and 0.977 inches diameter for tensile tests are suggested; the two small bars for white heart and the two larger for black heart.

Monel Cast Centrifugally

Centrifugally Cast Monel Metal, by J. E. Hurst, *The Metal Industry*, London, Aug. 21, 1931.

It is not known generally that monel metal can be cast satisfactorily by the centrifugal process. Cylindrical parts for valves, seats and disks, cylinder and pump liners, shaft sleeves and bushes have been cast extensively. The metal is melted in coke fired crucible furnaces and it has been found that the best pouring temperature is about 1500 degrees Cent. (2732 degrees Fahr.) Before it is poured the metal is deoxidized by the addition of magnesium, about 2 ounces to 100 pounds of metal. It is poured into metal molds on the regular centrifugal casting machines and the castings show the high degree of soundness and closeness of grain characteristic of castings in any metal made by the centrifugal process. Addition of silicon up to 2.75 per cent increases the hardness and tensile strength. The paper is based on results obtained at the plants of Messrs. Sheepbridge Stokes Centrifugal Castings Co. Ltd., in England, and Monel-Weir Ltd., in Scotland.

Studies Special Pig Iron

Migra-eisen, a New Special Pig Iron for High Quality Castings (Ueber Migra-Eisen, ein neues Spezialroheiesn fuer hochwertigen Guss), by Prof. E. Piwowarsky and A. Wirtz, *Die Giesserei*, Dusseldorf, Germany, Sept. 4, 1931.

A German pig iron producer through a thermal treatment which involves superheating the molten pig iron previous to casting it into pigs, claims it has developed a pig iron with certain desirable characteristics. These include a fine graphite structure, and good physical properties which persist after remelting in the cupola. Test by the authors on a mixture where the special iron replaced another component of the charge gave the following changes; Tensile strength increased from 27,900 to 34,800 pounds per square inch; bending strength from 50,600 to 58,000 pounds per square inch; deflection remained the same at 0.425-inch; impact strength on unnotched bars from 0.63 to 0.69, and brinell hardness from 174 to 193 in a 1.57-inch diameter bar. The increased values were ascertained with 50 per cent of the iron in the charge. Less iron also increased the values.

Educate the Young Boys

The Dinta System by A. Marson, *Foundry Trade Journal*, London, Sept. 10, 1931.

While on a tour through Germany the author made a close study of the D. I. N. T. A. system of education, now creating considerable interest on account of its logical application to post war German industrial conditions. The system, familiarly abbreviated to *Dinta* is the work of an industrial educational association and is quite distinct from state education. The object of the system is three-fold: To give a boy a good knowledge of the technical tools with which he will have to work; to educate the boy, not as a specialist in one line of work, but as a versatile worker who readily can adapt himself to a new job; to make each man happy, with a sound mind in a sound body and an interest in the well being and progress of his country. Other branches take up the problems of clerical workers, aged workers, home problems, and problems incident to management. The system is based on the premise that man power is more important than machinery and capital with which it is associated in modern industry.

Slag Affects Structure

Investigation of the Influence of Slag Composition on the Structure of Gray Iron Alloys (Untersuchungen ueber den Einfluss der Schlackenzusammensetzung auf das Gefuege grauer Eisenlegierungen), by E. Diepschlag and L. Treuheit, *Die Giesserei*, Duesseldorf, Germany, Sept. 4, 1931.

The authors melted a number of gray irons in a crucible type, electrical resistance furnace. The crucible had a capacity of 4.4 pounds, and for the various tests the crucible was lined with magnesite, loam sand, and alumina. Different slags, mainly silica-lime, and alumina-lime were used, and the results obtained are tabulated in the article. Under slag with much lime and alumina the iron exhibited the greatest tendency to freeze according to the unstable system with a finely-eutectic arrangement of the graphite in the remainder of the melt. The silica-lime slag did not affect the graphite formation as it was retained in the same form as in the original iron.

Uses Inclined Pouring

Pouring in the Inclined Position (La Coulee en position inclinee), by Ivan Lamoureux, *La Revue de Fonderie Moderne*, Paris, Oct. 10, 1931.

By inclining molds in relation to the horizontal plane, erosion of the mold from hot metal and its defects are avoided according to the author. The method is explained with a number of illustrated examples.

What the Foundries Are Doing

Reflecting the Activities of Gray Iron, Malleable, Steel and Brass Shops

Mansfield Foundry Co., Mansfield, Mass., has discontinued business and plant and fixtures will be sold.

Mason Machine Works Co., Taunton, Mass., has erected a new foundry on the site of a former plant.

Stevenson Foundry Co., Wellsville, O., has resumed operations on practically a full time basis.

A voluntary bankruptcy petition has been filed by the Wessling Brothers Foundry Co., Hamilton, O.

Collins Co., Collinsville, Conn., has discontinued its foundry business and will dismantle its casting shop.

Corona Bronze and Brass Foundry, 52 Seventh street, Long Island City, N. Y., bankrupt, recently was sold at auction.

Acme Aluminum Foundry Co. has moved its office from 814 West Seventy-fifth street to 6831-45 South Irving avenue, Chicago.

Plant of Valley Foundry Co., East Hampton, Conn., owned by Connecticut Foundry Co., Rocky Hill, Conn., has suffered damage by fire.

Leonard & Baker Stove Co., Taunton, Mass., is operating six days a week with 91 molders employed. E. L. Baker is president.

Plant of Star Cast Aluminum Co., 3778 North Fratney street, Milwaukee, was damaged $10,000 by fire and repairs will be made at once.

Shambow Shuttle Co., 642 Winter street, Woonsocket, R. I., is reported operating between four and five days per week.

The Haydenville Co., Haydenville, Mass., recently acquired the Victory Equipment Corp., 75 State street, Boston.

James H. Beans Foundry Co., first and Locust streets, Martins Ferry, O., has increased production to capacity, after several months of low operations.

Terre Haute Malleable Mfg. Co., Terre Haute, Ind., suffered damage to its annealing department to the extent of $40,000 to $50,000 recently.

Pangborn Corp., Crestview avenue, Hagerstown, Md., has deferred action on proposed new plant for a month. Bids have been taken and are under consideration.

Ideal Furnace Co., Milan, Mich., is operating on a five day week basis and from present indications the total number of days operated in 1931 will be greater than in 1930. The Ideal company has developed a new square boiler and has started the production of a new product.

J. & W. Jolly Inc., 529 South East street, Holyoke, Mass., is operating under a receivership. Martin L. Cramer, formerly treasurer of the company, has been appointed receiver.

Henry Perkins Co., Bridgewater, Mass., is working five days a week. Charles Perkins is president, E. R. Perkins, vice president, Millie Perkins, secretary-treasurer, E. R. Perkins, works manager, W. H. Nims, foundry foreman and Charles Breach, brass foundry foreman.

Hastings & Schoen Co. and the Hampden Brass Co., both located at 262 Liberty street, Springfield, Mass., have enjoyed good business throughout the past year.

Mead-Penn Iron Works Co., Mercer street, Meadville, Pa., is reported to have sufficient orders on hand to keep its plant in operation throughout the winter.

Brooklyn Technical High School, Brooklyn, N. Y., is completing a new building which will contain a modern foundry equipped to make gray iron, steel and alloy castings. Edwin W. Doe is instructor in charge of the foundry.

Jobbing foundries in the St. Louis district have a fairly large volume of business to complete, consisting chiefly of miscellaneous products. Plant operations since the first of October have ranged from four to five days a week, several plants reporting an even better average.

Patterson Foundry & Machine Co., East Liverpool, O., is taking bids on a steam-operated electric generating plant to cost $75,000 with equipment. Albert D. Birch is manager.

Wilkofsky Bros. Inc., Beaver Falls, Pa., has purchased the Murphy Furnace & Foundry Co., Beaver Falls and will continue to operate the plant. Wm. J. Wilkofsky is general manager.

Pittsburgh Malleable Iron Co., 35th and Charlotte street, Pittsburgh, advises that it has become insolvent and that the trustee under the mortgage has filed a bill for foreclosure.

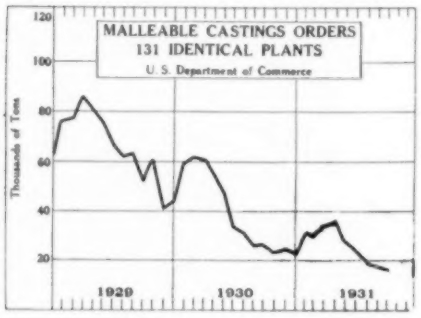
Sessions Foundry Co., Bristol, Conn., is working four days a week in some departments and expects to increase to five if present business activity continues.

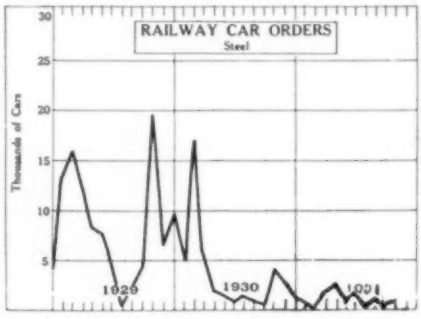
Wollaston Brass & Aluminum Foundry, Norfolk Downs, Quincy, Mass., is working full-time with good prospects for future business. E. H. Tibbetts is president and Charles E. Bevin is foundry foreman.

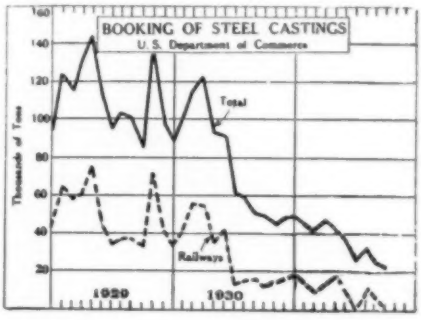
The Wandtke Pattern Works, 226 South Union street, Kokomo, Ind., has been moved to Anderson, Ind. A brass and aluminum foundry also will be established in connection with the pattern works. Harry J. Wandtke is proprietor.

Brooklyn Vault Light Co., 234 Monitor street, Brooklyn, N. Y., has been succeeded by Hinrichs Foundry & Vault Light Co. Inc. This represents only a change in name and officers and personnel will remain unchanged.

Chicago district foundry operating schedules were a shade improved at the beginning of the month. Merchant pig iron shipments to melters in October were nearly 40 per cent ahead of the low September rate. Aluminum foundries continued at four to five days a







RAW MATERIAL PRICES

Nov. 6, 1931

Iron	
No. 2, foundry, Valley	$16.00 to 16.50
No. 2 Southern, Birmingham	12.00
No. 2 foundry, Chicago	17.00
No. 2 foundry, Buffalo	17.00
Basic, Valley	15.00 to 15.50
Basic, Buffalo	16.50 to 17.00
Malleable, Chicago	17.00
Malleable, Buffalo	17.50
Coke	
Connellsville Beehive coke	$3.25 to 4.50
Wise county beehive coke	4.25 to 5.00
Detroit by-product coke	8.00
Scrap	
Heavy melting steel, Valley	$9.50 to 10.00
Heavy melting steel, Pitts.	10.00 to 10.50
Heavy melting steel, Chicago	7.75 to 8.25
Stove plate, Buffalo	8.50 to 8.75
Stove plate, Chicago	7.00 to 7.50
No. 1 cast, New York	7.00 to 7.50
No. 1 cast, Chicago	8.00 to 8.50
No. 1 cast, Philadelphia	11.50 to 12.50
No. 1 cast, Pittsburgh	10.00 to 10.50
No. 1 cast, Birmingham	9.00 to 10.00
Car wheels, iron, Pittsburgh	10.00 to 10.50
Car wheels, iron, Chicago	9.00 to 9.50
Railroad malleable, Chicago	8.00 to 8.50
Agricultural mal., Chicago	7.50 to 8.00
Malleable, Buffalo	10.00 to 10.50
Nonferrous Metals	**Cents per pound**
Casting copper, refinery	6.75 to 7.00
Straits tin	22.87½
Aluminum, No. 12, producers	22.00
Aluminum, No. 12 remelt	8.50 to 9.50
Lead, New York	3.85
Antimony, New York	6.75
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	3.15 to 3.20

week, due largely to demand for domestic cooking utensils.

Federal-Mogul Corp., Detroit, plans to enter the field of propeller wheel manufacture, according to H. Gray Muzzy, president. T. F. W. Meyer, long identified in the marine industry, has been placed in charge of sales of the newly formed division.

American Manganese Steel Co., Chicago, has been granted $20,000 fixed assessment for ten years on buildings and land recently purchased from Carbon Alloy Steels, Welland, Ont., and will spend $150,000 in rebuilding and equipping the plant for immediate operation with 150 men for 11 months each year.

Officials of the Doehler Die Casting Co., Batavia, N. Y., which operates two plants, believe that the acquisition of the die casting division of the Bohn Aluminum & Brass Corp., Detroit, will result in large increases in local production. Plans call for the addition of 30 casting machines to the battery of 45 now located at Batavia, it is understood.

Fulton Iron Works Co. has made a composition offer to creditors in the bankruptcy court in St. Louis, whereby the company will give notes maturing in 5 and 10 years in full settlement of claims; 60 per cent of the claims will be represented by five-year notes bearing 6 per cent interest and 40 per cent by ten-year notes bearing 8 per cent interest. A creditors' committee has recommended acceptance of the offer.

The Chevrolet Motor Co.'s gray iron foundry at Saginaw, which has been practically idle since mid-September, went into production on Oct. 19 of the engine blocks for the new model Chevrolet. Something like 3200 workmen returned to work. The plant will follow the working schedule of three 8-hour shifts for three or four days in each week.

Fisher Brass Inc., Marysville, O., has been incorporated to take over the Fisher Brass Co. The company has started operation with 65 per cent of the normal number of employes and expects soon to be working full force. The firm will specialize in bath, shower, lavatory and sink fixtures in chromium plated finish. Sidney Fisher is president of the new company.

Two pattern shops in the Muskegon, Mich., district are working full time with about 65 per cent of the normal number of employes. Officials report October the best month since spring. Two piston ring companies in that district began operations the latter part of October with a full crew. Several foundries including Campbell, Wyant and Cannon, the Lakey Foundry & Machine Co., and the West Michigan Steel Foundry Co., are reported to have prepared for increased schedules during November.

New Trade Publications

FACTORY SITES—The Kunkle Factory Site Service, Terminal Tower, Cleveland, recently has issued a booklet illustrating and describing industrial buildings and sites available in the Cleveland district.

ELECTRIC EQUIPMENT—A recent bulletin from the General Electric Co., Schenectady, N. Y., illustrates and describes general-purpose automatic time switches, electric time meters, and magnetic switches. Another leaflet covers blast gates for low pressure air and gas systems.

FLUX—Mathieson Alkali Works Inc., 250 Park avenue, New York, has prepared an interesting folder describing the use of its flux in reducing sulphur and preventing hard spots in gray iron castings. Photographs showing the refining of iron in four different foundries also are reproduced in the publication.

TESTING SIEVES—W. S. Tyler Co., Superior avenue and E. 36th street, Cleveland, has issued an interesting catalog entitled "The Profitable Use of Testing Sieves". Considerable information on the use of sieves in the testing laboratory has been included and halftones and etchings are used extensively to illustrate the text.

PLATING DIE CASTINGS — New Jersey Zinc Co., 160 Front street, New York, recently has issued a catalog entitled "The Plating of Rolled Zinc and Zinc Die Castings", by E. A. Anderson and C. E. Reinhard. A card giving the exact procedure followed in plating zinc die castings also is included with the bulletin.

GRINDERS——United States Electrical Tool Co., Cincinnati, recently has issued a 56-page catalog describing and illustrating its complete line of grinders, buffers and drills. Information is included on both the stand type and the portable type units, many of which have been designed especially for the foundry industry.

REFRACTORY CEMENT—James E. Dick, Salem Iron Foundry, Inc., Rose street, Salem, Mass., has issued a leaflet describing a new high temperature cement which is said to be particularly applicable to blast furnaces, annealing ovens, cupolas, ladle linings, furnace doors, etc. The material is a silicon carbide refractory and is said to possess minimum shrinkage.

TRAMRAIL EQUIPMENT—A bulletin entitled "Solves Foundry Industry Problems" recently has been issued by the Cleveland Electric Tramrail division of the Cleveland Electric Crane & Engineering Co., Wickliffe, Ohio, illustrating various uses for the tramrail system in handling materials in the foundry. That company also has issued a second bulletin entitled "Are Your Loads 2 Pounds or 10 Tons?" which illustrates additional foundry uses for hand or electric apparatus for tramrail system.

STEEL CASTINGS — Detroit Steel Casting Co., Detroit, Mich., has published a pamphlet entitled "A Classification of Steels for Steel Castings", containing a considerable amount of valuable technical information on steel castings. Information is included on carbon steels of varied content to meet specific requirements; low alloy steels of manganese nickel and manganese molybdenum types with varied carbon content to meet required specifications; alloy steels of nickel chromium and chrome vanadium, suitable for large castings or to meet higher specification ranges after special heat treatment; alloy steels of chrome molybdenum with varied carbon content and treatments to meet particular conditions of abrasive resistance and high strength; and alloy steels of chrome silicon and chrome silicon copper with low carbon and consequently high strength and ductility, which are able to withstand moderate high temperature conditions up to a maximum of 1650 degrees Fahr. Additional pamphlets of a similar nature are to be published in the future.

Old Man Accident Recently Was Buried at the Springfield, O. Plant of the Ohio Steel Foundry Co., Lima, O., the Entire Personnel Taking Some Part in the Services. This Illustratioin Shows Three of the Chief Mourners. Reading from Left to Right: John Lynch, Day Watchman, Roy Longsworth, Pattern Storage, and Gus Wendt, Foundry Foreman. The Company is taking part in the Safety Campaign Being Conducted in Ohio Under the Auspices of the Ohio Foundries Association, Cleveland

WHERE-TO-BUY

A classified list of advertisers according to products. ¶Index to advertisements give page number of any advertiser.

ABRASIVE WHEELS

Safety Grinding Wheel & Machine Co., Springfield, O.

ABRASIVES—Metallic

American Steel Abrasives Co., Galion, O.
Globe Steel Abrasive Co., Dept. F., Mansfield, O.
Patch-Wegner Co., Inc., Rutland, Vt.
Philadelphia Steel Abrasive Co., The, East of Lewis & Ashland Sts., Frankford, Philadelphia, Pa.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Steel Shot & Grit Co., Amesbury, Mass.
Steelblast Abrasives Co., 6536 Carnegie Ave., Cleveland, O.

ACETYLENE DISSOLVED OR IN CYLINDERS

Linde Air Products Co., 30 E. 42nd St., New York City.

ACETYLENE GENERATING APPARATUS

Linde Air Products Co., 30 E. 42nd St., New York City.

AIR COMPRESSORS

General Electric Co., Schenectady, N. Y.

ALKALI

Mathieson Alkali Wks., Inc., The, 250 Park Ave., New York, N. Y.

ALLOYS

Electro Metallurgical Sales Corp., 30 E. 42nd St., New York City.

ALUMINUM

British Aluminium Co., Ltd., 122 E. 42nd St., New York City.

ALUMINUM—Alloys and Ingots

British Aluminium Co., Ltd., 122 E. 42nd St., New York City.

ARC WELDING EQUIPMENT

General Electric Co., Schenectady, N. Y.

ARCHITECTS—Industrial

Austin Co., The, 16112 Euclid Ave., Cleveland, O.

ARRESTORS & COLLECTORS—Dust—See Dust Arresting and Collecting Systems

BABBITT METAL

Ajax Metal Co., 46 Richmond St., Philadelphia, Pa.

BARS (Steel)

Bethlehem Steel Co., Bethlehem, Pa.

BELLOWS—Molders

Osborn Mfg. Co., Inc., 5401 Hamilton Ave., Cleveland, O.

BLOWERS

General Electric Co., Schenectady, N. Y.

BOLTS AND NUTS

Bethlehem Steel Co., Bethlehem, Pa.

BOOKS—Technical

Penton Publishing Co., Cleveland.

BOTTOM PLATES—Steel

Truscon Steel Co. (Pressed Steel Div.) 6100 Truscon Ave., Cleveland, O.

BRONZE—Manganese

Ajax Metal Co., 46 Richmond St., Philadelphia, Pa.

BRUSHES—Foundry

Osborn Mfg. Co., Inc., 5401 Hamilton Ave., Cleveland, O.

BRUSHES—Motor and Generator

General Electric Co., Schenectady, N. Y.
United States Graphite Co., The, Saginaw, Mich.

BUCKETS

Penn Foundry & Mfg. Co., Reading, Pa.

BUCKETS—Clamshell, Dragline, Grab

Brosius, Edgar E., Inc., 19th St. & P. R. R., Sharpsburg P. O., Pittsburgh, Pa.

BUILDINGS—Foundry, Factory, Industrial

Austin Co., The, 16112 Euclid Ave., Cleveland, O.

BURNERS—Oil or Gas

Foundry Equipment Co., The, 1831 Columbus Rd., Cleveland, O.

BUSHINGS—Flask Pin

Michigan Screw Co., Lansing, Mich.

CALCIUM—SILICON

Electro Metallurgical Sales Corp., 30 E. 42nd St., New York City.

CALCIUM CARBIDE

Linde Air Products Co., 30 E. 42nd St., New York City.

CARBIC

Linde Air Products Co., 30 E. 42nd St., New York City.

CARBIDE

Linde Air Products Co., 30 E. 42nd St., New York City.

CARS—Platform, Industrial Railway, Transfer, Narrow Gage

Bethlehem Steel Co., Bethlehem, Pa.
Foundry Equipment Co., The, 1831 Columbus Rd., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Penn Foundry & Mfg. Co., Reading, Pa.

CARS & LOCOMOTIVES—Industrial

Industrial Equipment Co., The, Minster, O.

CASTINGS (Gray Iron)

Bethlehem Steel Co., Bethlehem, Pa.

CEMENT—High Temperature, Refractory

Alpha-Lux Co., Inc., 192 Front St., New York City.

CHARGING EQUIPMENT—Air Furnace

Euclid-Armington Corp., 1364 Chardon Rd., Euclid, Ohio.

CHEMICALS

Mathieson Alkali Wks., Inc., The, 250 Park Ave., New York, N. Y.

CHROMIUM

Electro Metallurgical Sales Corp., 30 E. 42nd St., New York City.

COAL

Hanna Furnace Corp., The, Detroit, Mich.

COAL CRUSHERS and Pulverizers

Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.

COAL—ORE—ASH HANDLING MACHINERY

Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.

COKE

Bethlehem Steel Co., Bethlehem, Pa.
Hanna Furnace Corp., The, Detroit, Mich.
Semet-Solvay Co., 61 Broadway, New York City.

CONVEYERS—Belt

Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.

CONVEYING AND ELEVATING EQUIPMENT

Arcade Mfg. Co., Dept. D., Freeport, Ill.
Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.
Cleveland Electric Tramrail Div. of Cleveland Crane & Eng. Co., Wickliffe, O.
Jeffrey Mfg. Co., The, Columbus, O.
National Engineering Co., 549 W. Washington Blvd., Chicago.
Osborn Mfg. Co., Inc., 5401 Hamilton Ave., Cleveland, O.

CORE BINDERS

Corn Products Refining Co., 17 Battery Place., New York City.
Smith, Werner G., Co., 2191 W. 110th St., Cleveland, O.

CORE BREAKERS

Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.

CORE COMPOUNDS

Corn Products Refining Co., 17 Battery Place, New York City.
Lindsay-McMillan Co., 930 S. Water St., Milwaukee, Wis.
Pennsylvania Lubricating Co., 34th & Smallman Sts., Pittsburgh.
Smith, Werner G., Co., 2191 W. 110th St., Cleveland, O.

CORE MAKING MACHINES

Arcade Mfg. Co., Dept. D, Freeport, Ill.
Demmler, Wm., & Bros., Kewanee, Ill.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh.
International Molding Machine Co., 2616 W. 16th St., Chicago, Ill.
Osborn Mfg. Co., Inc., 5401 Hamilton Ave., Cleveland, O.
Tabor Mfg. Co., The, 6225 Tacony St., Philadelphia, Pa.

CORE OIL

Lindsay-McMillan Co., 930 S. Water St., Milwaukee, Wis.
Smith, Werner G., Co., 2191 W. 110th St., Cleveland, O.

CORE OVENS—See Ovens—Core-Mold

CORE RACKS

Foundry Equipment Co., The, 1831 Columbus Rd., Cleveland, O.
Truscon Steel Co. (Pressed Steel Div.) 6100 Truscon Ave., Cleveland, O.

CORE RODS

Franklin Core Rod & Gagger Co., Franklin, Pa.

CORE ROOM EQUIPMENT

Truscon Steel Co. (Pressed Steel Div.) 6100 Truscon Ave., Cleveland, O.

CORE SAND MIXERS

National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.